

No: _____

SUBMITTAL COVERSHEET
Nanuet UFSD –Phase 3 Projects

Architect:

KSQ Architects
215 W 40th Street, 15th Floor
New York, NY 10018

Owner:

Nanuet Union Free School District
101 Church Street
Nanuet, NY 10954

Construction Manager:

Jacobs
One Penn Plaza, 54th floor
New York, NY 10019

Contractor: Joe Lombardo Plumbing & Heating of Rockland Inc

Contract: Ron Lombardo

Address: 321 Spook Rock Road Suite 109A

845-357-6537

Telephone: _____

Suffern, New York 10901

Fax: 845-357-8529

School Name: Nanuet Union Free School District Phase 3 Bond Projects @ Barr Middle School & Nanuet High School

Type of Submittal:

Re-submittal: ☐ No ☐ Yes

☐ Shop Drawings

☐ Product Data

☐ Schedule

☐ Sample

☐ _____

☐ Test Report

☐ Certificate

☐ Color Sample

☐ Warranty

☐ _____

Submittal Description:

STEAM AND CONDENSATE PIPING

Product Name: _____

Manufacturer: ALL

**Subcontractor/
Supplier:** FERGUSON

References:

Spec. Section No.: 232213

Drawing No(s): _____

Paragraph: _____

Rm. or Detail No(s): _____

Architect's/ Engineer's Review Stamp

Contractor Review Statement:

These documents have been checked for accuracy and coordinated with job conditions and Contract requirements by this office and have been found to comply with the provisions of the Contract Documents.

Ronald J. Lombardo

9-14-23

Name:

Date:

Company Name:

Joe Lombardo Plumbing & Heating of Rockland Inc.

Remarks:



Wheatland ASTM A 53 Schedule 40 and Schedule 80 Pipe

www.wheatland.com

Wheatland Steel Pipe is made by specialists who understand that it's the small details that make the difference between average products and superior products. At the Wheatland Plant, most department heads and foremen have been employed in some phase of pipe manufacturing for 25 or more years.

This kind of specialization, experience and knowledge pays off...in workable, threadable, uniform pipe. Delivered clean. Delivered promptly.

Wheatland specializes in manufacturing welded steel pipe in 1/2 through 4 nominal sizes. Available inventory in 1/8 to 12 pipe sizes produced to various ASTM standards is maintained to meet your pipe requirements.

Care, pride and personal concern are bonus features that go into every inch of Wheatland Pipe. Don't settle for less.

Make sure it's quality. Make sure it's Wheatland.

Standard Pipe Schedule 40 ASTM A 53 Grades A and B

NPS Designator	DN Designator	Outside Diameter		Inside Diameter		Wall Thickness		Nominal Weight (Mass) per unit Length			
		(Inches)	(mm)	(Inches)	(mm)	(Inches)	(mm)	Plain End (lb/ft)	Plain End (kg/m)	Threads & Coupling (lb/ft)	Threads & Coupling (kg/m)
1/8	6	0.405	10.3	0.269	6.8	0.068	1.73	0.24	0.37	0.25	0.37
1/4	8	0.540	13.7	0.364	9.2	0.088	2.24	0.43	0.63	0.43	0.63
3/8	10	0.675	17.1	0.493	12.5	0.091	2.31	0.57	0.84	0.57	0.84
1/2	15	0.840	21.3	0.622	15.8	0.109	2.77	0.85	1.27	0.86	1.27
3/4	20	1.050	26.7	0.824	20.9	0.113	2.87	1.13	1.69	1.14	1.69
1	25	1.315	33.4	1.049	26.6	0.133	3.38	1.68	2.50	1.69	2.50
1-1/4	32	1.660	42.2	1.380	35.1	0.140	3.56	2.27	3.39	2.28	3.40
1-1/2	40	1.900	48.3	1.610	40.9	0.145	3.68	2.72	4.05	2.74	4.04
2	50	2.375	60.3	2.067	52.5	0.154	3.91	3.66	5.44	3.68	5.46
2-1/2	65	2.875	73.0	2.469	62.7	0.203	5.16	5.80	8.63	5.85	8.67
3	80	3.500	88.9	3.068	77.9	0.216	5.49	7.58	11.29	7.68	11.35
3-1/2	90	4.000	101.6	3.548	90.1	0.226	5.74	9.12	13.57	9.27	13.71
4	100	4.500	114.3	4.026	102.3	0.237	6.02	10.80	16.07	10.92	16.23
5	125	5.563	141.3	5.047	158.2	0.258	6.55	14.63	21.77	14.90	22.07
6	150	6.625	168.3	6.065	154.1	0.280	7.11	18.99	28.26	19.34	28.58
8	200	8.625	219.1	7.981	202.7	0.322	8.18	28.58	42.55	29.35	43.73
10	250	10.750	273.0	10.020	254.5	0.365	9.27	40.52	60.29	41.49	63.36
Standard Pipe											
12'	300	12.750	323.8	12.000	304.8	0.375	9.52	9.61	3.78	51.28	76.21

Note¹ NPS 12 dimensions are for standard wall pipe, not schedule 40.

Product Type and Specification:

Standard welded pipe is produced in 1/2 to 6 trade sizes. Wheatland pipe is produced to ASTM A 53 Grades A and B, A 501, and A 589 Type II, API 5L and Federal Specification WW-P404. All pipe threads conform to ANSI B1.20.1. Merchant couplings comply with ASTM A 865.

Specifications and descriptions are accurate as known at time of publication and subject to change without notice.

Wheatland ASTM A 53 Grades A & B Schedule 40 Pipe



Extra Heavy Pipe Schedule 80 ASTM A 53 Grade A

NPS Designator	DN Designator	Outside Diameter		Inside Diameter		Wall Thickness		Nominal Weight (Mass) per unit Length			
		(Inches)	(mm)	(Inches)	(mm)	(Inches)	(mm)	Plain End (lb/ft)	Plain End (kg/m)	Threads & Coupling (lb/ft)	Threads & Coupling (kg/m)
1/8	6	0.405	10.3	0.215	5.5	0.095	2.41	0.31	0.47	0.32	0.46
1/4	8	0.540	13.7	0.302	7.7	0.119	3.02	0.54	0.80	0.54	0.80
3/8	10	0.675	17.1	0.423	10.7	0.126	3.20	0.74	1.10	0.74	1.10
1/2	15	0.840	21.3	0.549	13.9	0.147	3.73	1.09	1.62	1.09	1.62
3/4	20	1.050	26.7	0.742	18.8	0.154	3.91	1.48	2.20	1.48	2.21
1	25	1.315	33.4	0.957	24.3	0.179	4.55	2.17	3.24	2.19	3.25
1-1/4	32	1.660	42.2	1.278	32.5	0.191	4.85	3.00	4.47	3.03	4.49
1-1/2	40	1.900	48.3	1.500	38.1	0.200	5.08	3.63	5.41	3.65	5.39
2	50	2.375	60.3	1.939	49.3	0.218	5.54	5.03	7.48	5.08	7.55
2-1/2	65	2.875	73.0	2.323	59.0	0.276	7.01	7.67	11.41	7.75	11.52
3	80	3.500	88.9	2.900	73.7	0.300	7.62	10.26	15.27	10.35	15.39
3-1/2	90	4.000	101.6	3.364	85.4	0.318	8.08	12.52	18.63	12.67	18.82
4	100	4.500	114.3	3.826	97.2	0.337	8.56	15.00	22.32	15.20	22.60
5	125	5.563	141.3	4.813	122.3	0.375	9.52	20.80	30.94	21.04	31.42
6	150	6.625	168.3	5.761	146.3	0.432	10.97	28.60	42.56	28.88	43.05
8	200	8.625	219.1	7.625	193.7	0.500	12.70	43.43	64.64	44.00	65.41

Permissible Variations for ASTM A 53 Grades A and B Pipe			
	O.D.	Over	Under
Outside Diameter	NPS 1/8 to 1-1/2 DN 6 to 40	1/64" (0.4mm)	1/64" (0.4mm)
	NPS 2 and up DN 50 and up	1%	1%
Wall Thickness at Any Point		-----	12.5%



ASTM A 53 Grades A and B: Black and Galvanized Pipe is manufactured for ordinary use in steam, water, gas, and air lines. UL Listed and FM Approved, sizes 1" through 6" nominal, for use in Fire Sprinkler Pipe Applications.

Mechanical Properties

Grade A: Yield 30,000 [205 Mpa] psi minimum Tensile: 48,000 psi [330 Mpa] minimum

Grade B: Yield 35,000 [240 Mpa] psi minimum Tensile: 60,000 psi [415 Mpa] minimum

For additional information or to order, contact our pipe department at 800.257.8182,
Fax: 724.346.7260, e-mail info@wheatland.com

Wheatland ASTM A 53 Grade A Schedule 80 Pipe



232213 - LOW PRESSURE STEAM AND CONDENSATE

WARD MANUFACTURING

P.O. Box 9
117 Gulick Street
Blossburg, PA 16912-0009

(570) 638-2131

January 11, 2013

To whom it may concern:

I hereby certify that our products listed below comply with the current specification. The products listed below are made with pride in Blossburg, Pennsylvania, USA.

2.2 & 2.3 FITTINGS

CL 150 Malleable Iron Threaded Fittings

Fed. Spec. WW - P - 521		
ASME	B16.3	(Dimensions)
ASTM	A-197	(Chemical & Physical Properties)
ASTM	A-153	(For Galvanized Product)
ANSI/ASME	B1.20.1	(Tapered Pipe Threads)

CL 300 Malleable Iron Threaded Fittings

ASME	B16.3	(Dimensions)
ASTM	A-197	(Chemical & Physical Properties)
ASTM	A-153	(For Galvanized Product)
ANSI/ASME	B1.20.1	(Tapered Pipe Threads)

Unions, Union Fittings, Flange Unions & Companion Flanges

2.5 UNIONS >>>>	CL 150 Malleable Iron to Brass Seat, Iron to Iron Unions	
	Fed. Spec. WW - U - 531	ASME B16.39
	CL 250 Malleable Iron to Brass Seat, Unions	
	Fed. Spec. WW - U - 531	ASME B16.39
	CL 300 Malleable Iron to Brass Seat, Iron to Iron Unions	
	MIL - U - 18250	ASME B16.39
	CL 125 - CL 250 Cast Iron Flanges	ASME B16.1
	ASTM	A-126 (Chemical & Physical Properties)
	ASTM	A-153 (For Galvanized Product)
	ANSI/ASME	B1.20.1 (Tapered Pipe Threads)

Bushings and Plugs

Fed. Spec. WW - P - 471		
ASME	B16.14	(Dimensions)
ANSI/ASME	B1.20.1	(Tapered Pipe Threads) Supersedes B-2-1
ASTM	A-197 or	(Chemical & Physical Properties)
	A-126	
ASTM	A-153	(For Galvanized Product)

CL 125 Cast Iron Threaded Fittings

Fed. Spec. WW - P - 501		
ASME	B16.4	(Dimensions)
ASTM	A-126	(Chemical & Physical Properties)
ASTM	A-153	(For Galvanized Product)
ANSI/ASME	B1.20.1	(Tapered Pipe Threads)

Top Beam & C-Clamps

ASTM	A-197	(Chemical & Physical Properties)
ASTM	A-153	(For Galvanized Product)
UL	203	(Test Parameters)

Drainage Fittings

ASME	B16.12
ASTM	A-126
ASTM	A-153
ANSI/ASME	B1.20.1

(Dimensions)
(Chemical & Physical Properties)
(For Galvanized Product)
(Tapered Pipe Threads)

Cast Iron Flanges

ASME	B16.1
ASTM	A-126
ASTM	A-153
ANSI/ASME	B1.20.1

(Dimensions)
(Chemical & Physical Properties)
(For Galvanized Product)
(Tapered Pipe Threads)

WARDLOX Plain-End Fittings

ASTM	A-126
ASTM	D2000
ANSI/ASME	B1.20.1

(Chemical & Physical Properties, Housing)
(Gaskets, Temperature Range)
(Tapered Pipe Threads)

TEE-LOX Mechanical Branch Connectors

ASTM	A-126
ASTM	D2000
ANSI/ASME	B1.20.1

(Chemical & Physical Properties, Housing)
(Gaskets, Temperature Range)
(Tapered Pipe Threads)

Full Standard Merchant Couplings

ASTM	A-865
ASTM	A-53
ANSI/ASME	B1.20.1

(Dimensions)
(Chemical & Physical Properties)
(Tapered Pipe Threads)

Half Standard Merchant Couplings

ASTM	A-865
ASTM	A-53
ANSI/ASME	B1.20.1

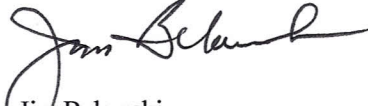
(Dimensions)
(Chemical & Physical Properties)
(Tapered Pipe Threads)

2.3 & 2.3 Welded Steel Pipe Nipples

NIPPLES SCH 40	ASTM	A-733
ON STEAM	ASTM	A-53
AND SCH 80	ANSI/ASME	B1.20.1
ON CONDENSE		

(Dimensions)
(Chemical & Physical Properties)
(Pipe Threads)

Sincerely,


Jim Belawski
Manager of Quality Assurance

2.2 & 2.3 - 2 - WELDED FITTINGS



Even with all the advances in technology today, the wholly welded piping system has for decades remained the best choice for use in high pressure and high temperature application. Many piping jobs in schools, industrial plants, refineries and factories have benefited from the inherent advantages of a completely welded system. It becomes a closed container joining pipes, valves, fittings, and flanges. A welded joint actually becomes part of the pipe, minimizing leak potential. This provides greater margins of safety, especially under conditions of high internal pressures. Additionally, welding fittings form a continuous metal structure with the pipe, adding forged-in strength to any piping system. Furthermore, smooth forged fittings simplify insulation and take up less space.

ASTM A 234

Scope

This standard covers wrought carbon steel fittings of seamless and welded construction which are manufactured to the dimensional specifications of ASME B16.9 and B16.28. These fittings are primarily for use in pressure piping and in pressure vessel fabrication for service at moderate and elevated temperatures.

Materials

The starting material for fittings shall consist of killed steel, forgings, bars, plates, seamless or fusion-welded tubular products with filler metal added and shall conform to the the chemical requirements of ASTM A 234. Unless otherwise specified, carbon steel plates may be either coarse grain or fine grain practice.

Manufacture

Forging or shaping operations are performed by hammering, pressing, piercing, extruding, upsetting, rolling, bending, machining, or by a combination of two or more of these operations. The forming process shall be applied so that it will not produce injurious imperfections in the fittings.

Heat Treatment

Hot-formed WPB fittings, upon which the final forming operation is completed at a temperature above 1150°F and below 1800°F, need not be heat treated.

Cold-Formed WPB fittings, upon which the final forming operation is completed at a temperature below 1150°F, shall be normalized, or shall be stress relieved at 1100°F to 1275°F.

Fitting Summary Data Sheet

Chemical requirements (in %):

<u>Carbon</u>	<u>Manganese</u>	<u>Phosphorus (max)</u>	<u>Sulfur (max)</u>
.30 max	.29-1.06	.050	.058

<u>Silicon</u>	<u>Chromium</u>	<u>Molybdenum</u>	<u>Nickel</u>	<u>Copper</u>
.10 min	.40 max	.15 max	.40 max	.40 max

<u>Vanadium</u>	<u>Columbium</u>
.08 max	.02 max

Mechanical requirements:

Tensile Strength	60,000-85,000 psi
Yield Strength (min)	35,000 psi
Elongation	- Longitudinal: 22%
	- Transverse: 14%

Dimensions

Butt-welding fittings and butt-welding short radius elbows and returns purchased in accordance with this specification shall conform to the dimensions and tolerances given in the latest revision of ANSI B16.9 and B16.28, respectively.

Certification

When requested by the purchaser, the manufacturer shall provide a certificate of compliance to this specification.

If requested to provide test reports, the manufacturer shall also provide the following where applicable:

- * Chemical analysis results. When the amount of an element is less than .02%, the analysis for that element is reported as "<0.02%."
- * Tensile property results, report the yield strength and ultimate strength in ksi [or MPa] and elongation in percent,
- * Hardness acceptable in accordance with Section 10 of ASTM A-234,
- * Seamless or Welded,
- * Type of Heat Treatment, if any,
- * Starting material, specifically pipe, plate, etc.,
- * Statement regarding radiographic or ultrasonic examination.
- * Any supplemental testing required by the purchase order.

Product Marking

All fittings shall have the prescribed information stamped or otherwise suitable marked on each fitting in accordance with ASTM A 234/MSS SP-25. A Weldbend fitting is marked as follows:
Weldbend's Name, Nominal Pipe Size, Pipe Wall Thickness Designation, Material Grade (WPB/WPC) and Heat Identification Number.

Note: All information contained in this document, and for a complete description of all requirements, refer to ASTM A 105. Sheets are subject to change without notice.

2.5 - B - WELD FLANGES



Even with all the advances in technology today, the wholly welded piping system has for decades remained the best choice for use in high pressure and high temperature application. Many piping jobs in schools, industrial plants, refineries, and factories have benefited from the inherent advantages of a completely welded system. It becomes a closed container joining pipes, valves, fittings, and flanges. A welded joint actually becomes part of the pipe, minimizing leak potential. This provides greater margins of safety, especially under conditions of high internal pressures. Additionally, welding fittings form a continuous metal structure with the pipe, adding forged-in strength to any piping system. Furthermore, smooth forged flanges simplify insulation and take up less space.

ASTM A 105

Scope

This standard covers forged carbon steel piping components for ambient- and higher-temperature service in pressure systems. Flanges are ordered either to dimensions specified by the purchaser or to dimensional specifications such as ASME 16.5 and API 6A. Forgings made to ASTM A 105 are normally limited to a maximum weight of 10,000 lb.

Materials

Weldbend flanges are made by hammering, pressing, rolling and/or machining cast or forged bars, billets or slabs. These adhere to the extent described in the following sections.

Manufacture

ASTM A 105 covers the requirements for forged steel components as finished products only.

The requirements for raw materials are covered by the standards specified in Section 2: Referenced Documents of ASTM A 105.

Heat Treatment

Heat treatment is not a mandatory requirement of this specification except for the following piping components:

- * Flanges above Class 300,
- * Flanges of special design where the design pressure at the design temperature exceeds the pressure-temperature ratings of Class 300, Group 1.1,
- * Flanges of special design where the design pressure or design temperature is not known.

Heat treatment, when required by the above, shall be annealing, normalizing, normalizing and tempering, or quenching and tempering in accordance with ASTM A 961.

Flange Summary Data Sheet

Chemical requirements (in %):

<u>Carbon</u>	<u>Manganese</u>	<u>Phosphorus (max)</u>	<u>Sulfur (max)</u>
.35 max	.60-1.05	.035	.040

<u>Silicon</u>	<u>Copper</u>	<u>Nickel</u>	<u>Chromium</u>
.10-.35	.40 max	.40 max	.30 max

<u>Molybdenum</u>	<u>Vanadium</u>	<u>Columbium</u>
.12 max	.08 max	.02 max

Mechanical requirements:

Tensile Strength (min)	70,000 psi
Yield Strength (min)	36,000 psi
Basic minimum elongation	30%
for walls 5/16 in. and over	
in thickness, strip tests.	
Reduction of area (min)	30%
Hardness, HB (max)	187

Dimensions

Weldbend flanges are manufactured in accordance with ASME B 16.5 (24" NPS and smaller) and ASME B 16.47 (26" - 60" NPS).

Certification

For forgings made to specified dimensions agreed upon by the purchaser, and for forgings made to dimensional standards, the application of identification marks, as required by ASTM A 961, shall be the certification that the forgings have been furnished in accordance with the requirements of this standard. The specification designation included on test reports shall include the year of issue and revision letter, if any.

Test Reports: When test reports are required, Weldbend will also provide the following, if applicable:

- *Type of heat treatment,
- *Tensile property results, i.e., yield strength and ultimate strength in ksi, elongation and reduction in area, in percent,
- *Chemical analysis results,
- *Hardness results, and,
- *Any supplementary testing required by the purchase order.

Product Marking

All flanges shall have the prescribed information stamped or otherwise suitable marked on each flange in accordance with the Standard/MSS SP-25. A Weldbend flange is marked as follows:

Weldbend's Name, Nominal Pipe Size, A105/SA105, Bore Designation, Heat Identification Number and manufacture date.

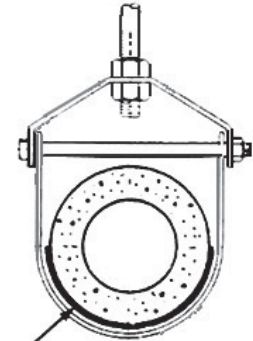
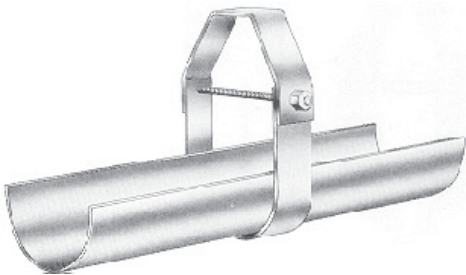
Note: All information contained in this document, and for a complete description of all requirements, refer to ASTM A 105. Sheets are subject to change without notice.

FIG. 220

CLEVIS HANGER WITH WELDED SHIELD

MATERIAL: Carbon steel or
FINISH: electro galvanized.
SERVICE: For vapor sealed lines.
ORDERING: Specify pipe size, figure number, insulation thickness and finish.

PIPE SIZE	HANGER SIZING GUIDE					
	THICKNESS OF PIPE INSULATION					
	½"	1"	1½"	2"	2½"	3"
½	1½	2½	3½	5	6	7
¾	2	3	3½	5	6	7
1	2	3	4	5	6	7
1¼	2½	3½	4	5	6	7
1½	2½	3½	5	6	7	8
2	3	4	5	6	7	8
2½	3½	5	6	7	8	10
3	4	5	6	7	8	10
3½	5	6	7	8	10	10
4	5	6	7	8	10	10
5	6	7	8	10	10	12
6	7	8	10	10	12	12
8	10	10	12	12	14	16
10	12	12	14	16	16	18
12	14	16	16	18	18	20
14	16	16	18	18	20	20
16	18	18	20	20	24	24

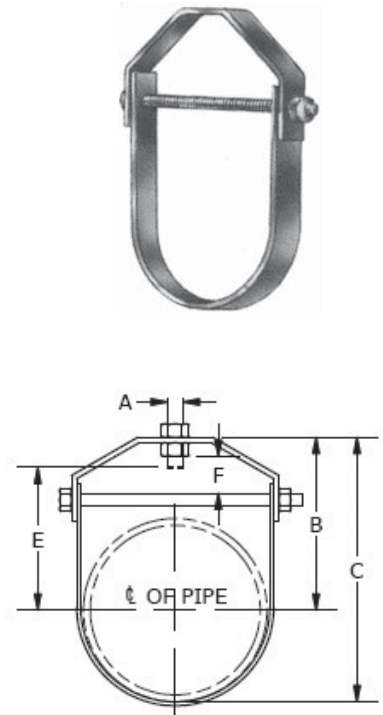


WITH WELDED SHIELD

FIG. CT200**COPPER TUBING CLEVIS HANGER**

MATERIAL: Carbon steel.
FINISH: Copper plated.
SERVICE: For the suspension of stationary copper tubing lines.
ORDERING: Specify tubing size and figure number.
APPROVALS: FS WW-H-171E TYPE 12.

TUBING SIZE	MATERIAL SIZE		A	B	C	E	F	WEIGHT EACH, LBS.
	UPPER	LOWER						
1/2	18ga. x 7/8	18ga. x 7/8	3/8	1 7/8	2 3/16	1 1/2	1/2	.12
3/4	18ga. x 7/8	18ga. x 7/8	3/8	1 3/4	2 1/8	1 3/8	1/2	.12
1	18ga. x 7/8	18ga. x 7/8	3/8	1 13/16	2 5/16	1 7/16	1/2	.14
1 1/4	18ga. x 7/8	18ga. x 7/8	3/8	2 1/8	2 3/4	1 11/16	3/4	.17
1 1/2	18ga. x 7/8	18ga. x 7/8	3/8	2 1/2	3 1/4	2 1/8	15/16	.20
2	14ga. x 7/8	16ga. x 7/8	3/8	2 15/16	4	2 9/16	1 1/16	.38
2 1/2	12ga. x 1 3/16	14ga. x 1 3/16	1/2	4 7/8	5 3/4	3 7/8	2 1/16	.71
3	12ga. x 1 3/16	14ga. x 1 3/16	1/2	4 1/2	6 1/8	3 15/16	2	.76
3 1/2	12ga. x 1 3/16	14ga. x 1 3/16	1/2	5 9/16	7 7/8	5	2 5/8	.82
4	11ga. x 1 3/16	14ga. x 1 3/16	1/2	5 7/8	7 7/8	5 1/4	2 9/16	1.02
5	8ga. x 1 1/4	8ga. x 1 1/4	5/8	5 7/8	8 3/4	5 3/8	1 5/8	1.68
6	8ga. x 1 1/4	8ga. x 1 1/4	5/8	6 1/16	9	5 3/8	1 1/2	1.84

**FIG. CT420****COPPER TUBING RISER CLAMP**

MATERIAL: Carbon steel.
FINISH: Copper plated.
SERVICE: For support of tubing risers.
ORDERING: Specify tubing size and figure number.
APPROVALS: MSS SP-58 & SP-69 TYPE 8
 FS WW-H-171E TYPE 8

NOMINAL TUBING SIZE	A	MATERIAL SIZE	REC. LOAD LBS.	WEIGHT EACH, LBS.
1/2	6 3/4	1/8 x 1	225	.69
3/4	7 1/16	1/8 x 1	225	.73
1	9 1/4	1/8 x 1	250	.75
1 1/4	9 5/8	1/8 x 1	250	.77
1 1/2	10 1/8	1/8 x 1	500	.80
2	10 3/4	1/8 x 1 1/4	500	1.05
2 1/2	11 1/4	3/16 x 1 1/4	500	1.68
3	11 1/2	3/16 x 1 1/4	500	1.78
3 1/2	12 1/4	3/16 x 1 1/4	500	1.91
4	12 3/4	3/16 x 1 1/4	500	2.05
5	14	1/4 x 1 1/2	815	3.46
6	15 1/2	1/4 x 1 1/2	815	3.86

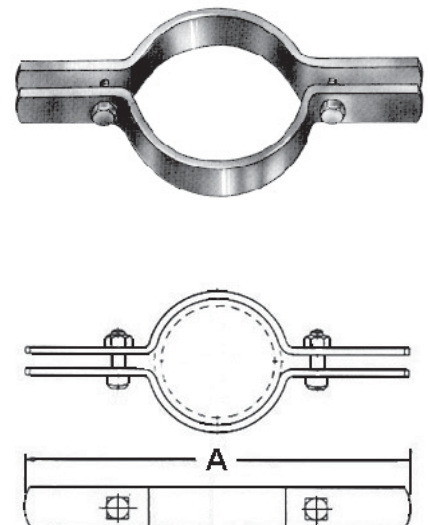
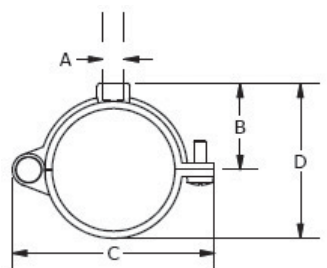
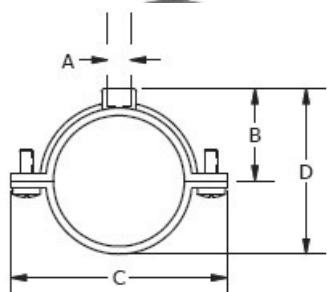
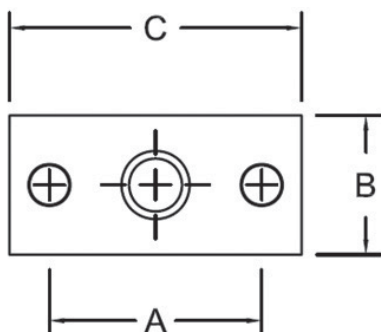


FIG. CT100**COPPER TUBING SPLIT RING HANGER**

MATERIAL: Malleable iron.
FINISH: Copper epoxy coated (COPPER-GARD).
ORDERING: Specify tubing size and figure number.
SERVICE: For suspension of non-insulated stationary tubing lines.
APPROVALS: MSS SP-58 & SP-69 TYPE 12
 FS WW-H-171E TYPE 25

TUBE SIZE	MAX. REC. LOAD, LBS.	A ROD SIZE	B	C	D	WEIGHT PER 100, LBS.
1/4*	180	3/8	9/16	1 3/4	7/8	7.3
3/8*	180	3/8	5/8	1 3/4	1 1/16	8.0
1/2	180	3/8	11/16	1 7/8	1 1/8	8.7
3/4	180	3/8	13/16	2 1/4	1 3/8	9.6
1	180	3/8	15/16	2 1/2	1 5/8	12.8
1 1/4	180	3/8	1 1/16	2 7/8	1 7/8	14.1
1 1/2	180	3/8	1 3/16	3	2 3/16	17.9
2	180	3/8	1 7/16	3 1/2	2 11/16	22.9
2 1/2*	300	1/2	1 7/8	4 15/16	2 7/16	44.9
3*	300	1/2	2 1/8	5 1/2	4 1/16	66.3
4*	300	1/2	2 5/8	6 5/8	5 1/16	75.3

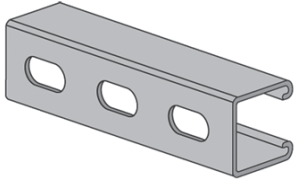
*Sizes 1/4", 3/8", 2 1/2", 3" and 4" are hinged style

FIG. CT105**COPPER HANGER FLANGE**

MATERIAL: Malleable iron.
FINISH: Copper epoxy coated (COPPER-GARD)
SERVICE: For suspension of non-insulated stationary tubing lines.
ORDERING: Specify tap size and figure number.

ROD SIZE	A	B	C	WEIGHT PER 100, LBS.
3/8	1 15/16	1 5/16	2 3/4	17
1/2	1 15/16	1 5/16	2 3/4	17

FIG. H132

STRUT

MATERIAL: Carbon steel
FINISH: Pre-galvanized (ASTM-A653) or epoxy coated green.
ORDERING: Specify size, figure number, length and finish.

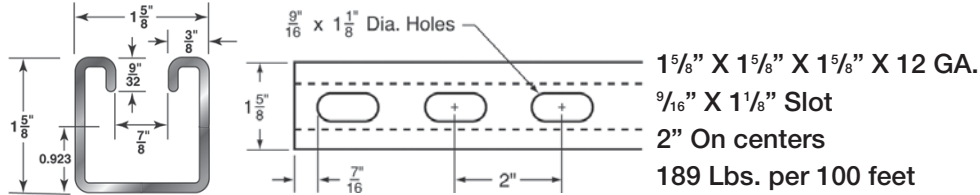
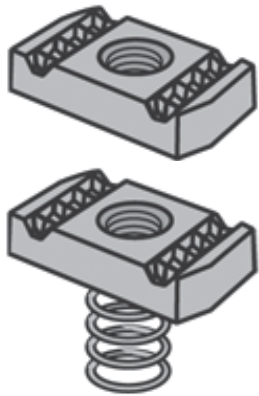


FIG. SN

STRUT NUT

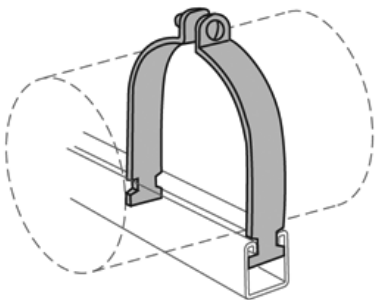
MATERIAL: Carbon steel
FINISH: Electro-galvanized.
ORDERING: Specify size with or without spring and figure number.

ROD SIZE	WITHOUT SPRING		WITH SPRING	
	STD. PKG.	WEIGHT EACH, LBS.	STD. PKG.	WEIGHT EACH, LBS.
1/4	100	.067	100	.076
3/8	100	.094	100	.102
1/2	100	.09	100	.094
5/8	100	.13	50	.15
3/4	100	.13	50	.15

FIG. SPC

STRUT PIPE CLAMP

MATERIAL: Carbon steel
FINISH: Electro-galvanized.
ORDERING: Specify pipe/tube size and figure number.



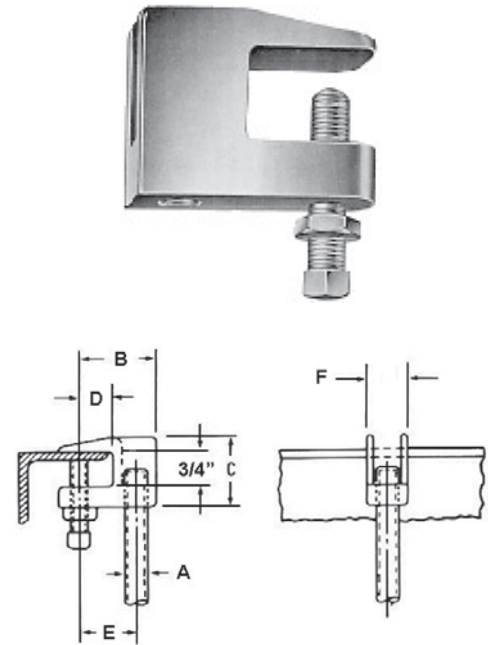
PIPE/TUBE SIZE	STRUT PIPE CLAMP		STRUT TUBE CLAMP	
	STD. PKG.	WEIGHT EACH, LBS.	STD. PKG.	WEIGHT EACH, LBS.
3/8	100	.106	100	.084
1/2	100	.108	100	.091
3/4	100	.138	100	.102
1	100	.156	100	.15
1 1/4	100	.191	100	.17
1 1/2	50	.286	100	.182
2	50	.336	50	.316
2 1/2	50	.372	50	.346
3	50	.446	50	.386
3 1/2	25	.576	50	.54
4	25	.628	25	.606
5	25	.732	25	.69
6	25	.976	25	.91
8	25	1.24		

NOTE: Tubing sizes only available up to 4".

FIG. 635**JUNIOR TOP BEAM CLAMP**

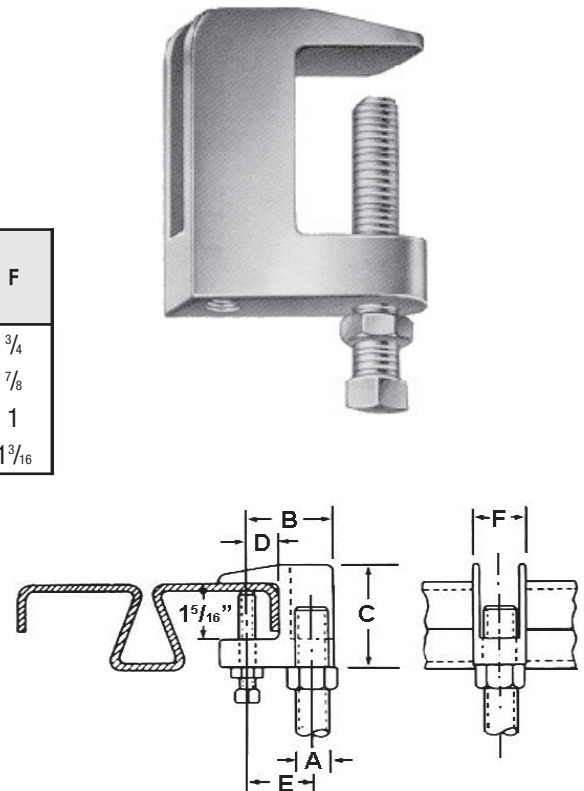
MATERIAL: Malleable Iron.
FINISH: electro-galvanized.
SERVICE: For use under roof installations with bar joist type construction where the thickness of the joist does not exceed $\frac{5}{8}$ ".
ORDERING: Specify size, figure number, and finish.
APPROVALS: MSS SP-58 & SP-69 TYPE 19
 FM ($\frac{3}{8}$ " & $\frac{1}{2}$ " rod)
 UL

ROD SIZE A	SIZE PIPE	MAX RECOMMENDED LOAD, LBS.	WEIGHT PER 100, LBS.	B	C	D	E	F
$\frac{3}{8}$	$\frac{1}{2}$ to 2	350	30	$1\frac{1}{2}$	$1\frac{7}{16}$	$\frac{3}{4}$	$1\frac{3}{16}$	$\frac{3}{4}$
$\frac{1}{2}$	$2\frac{1}{2}$ to $3\frac{1}{2}$	470	39	$1\frac{5}{8}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{4}$	$\frac{7}{8}$
$\frac{5}{8}$	4 to 5	550	40	$1\frac{3}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{3}{32}$	1
$\frac{3}{4}$	6	700	67	$2\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{1}{16}$	$1\frac{5}{16}$	$1\frac{1}{4}$
$\frac{7}{8}$	8	1000	66	$2\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{1}{16}$	$1\frac{5}{16}$	$1\frac{1}{4}$

**FIG. 640****TOP BEAM CLAMP**

MATERIAL: Malleable Iron.
FINISH: electro-galvanized.
SERVICE: For use under roof installations with bar joist type construction where the thickness of the joist does not exceed $1\frac{1}{4}$ ".
ORDERING: Specify size, figure number and finish.

ROD SIZE A	SIZE PIPE	MAX RECOMMENDED LOAD, LBS.	WEIGHT PER 100, LBS.	B	C	D	E	F
$\frac{3}{8}$	$\frac{1}{2}$ to 2	400	38	$1\frac{7}{16}$	2	$\frac{3}{4}$	$1\frac{3}{16}$	$\frac{3}{4}$
$\frac{1}{2}$	$2\frac{1}{2}$ to $3\frac{1}{2}$	500	49	$1\frac{5}{8}$	$2\frac{1}{16}$	$\frac{3}{4}$	$1\frac{1}{4}$	$\frac{7}{8}$
$\frac{5}{8}$	4 to 5	850	66	$1\frac{3}{4}$	$2\frac{1}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	1
$\frac{3}{4}$	6	900	83	$1\frac{7}{8}$	$2\frac{3}{8}$	$\frac{3}{4}$	$1\frac{3}{8}$	$1\frac{3}{16}$



Double

PRODUCT INFORMATION

Double *Shield Expansion Anchor*

PRODUCT DESCRIPTION

The Double is a dual expansion machine bolt anchor particularly suited for materials of questionable strength. It can be used in solid concrete, block, brick, and stone. Job site tests are recommended when used in base materials of questionable strength.

FEATURES AND BENEFITS

- Performs in base material of questionable strength
- Internally threaded anchor for easy removability and service work
- Corrosion resistant body

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 3

GUIDE SPECIFICATIONS

CSI Divisions: 03151-Concrete Anchoring, 04081-Masonry Anchorage and 05090-Metal Fastenings. Expansion anchors shall be Double as supplied by Powers Fasteners, Inc., Brewster, NY.

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Installation and Material Specifications.....	1
Performance Data.....	2
Design Criteria.....	3
Ordering Information.....	4



Double

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry

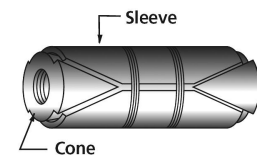
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, d					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	3/4	7/8	1	1 1/4
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Sleeve Length (in.)	1	1 3/16	1 9/16	2	2 1/4	3 1/4
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11	3/4-10
Thread Length In Cone (in.)	1/2	1/2	5/8	3/4	7/8	1 1/8
Overall Anchor Length (in.)	1 3/8	1 5/8	2	2 1/2	2 3/4	3 15/16

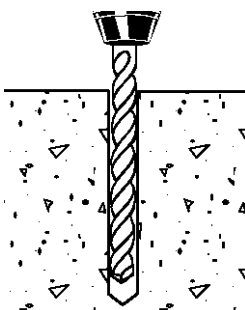
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

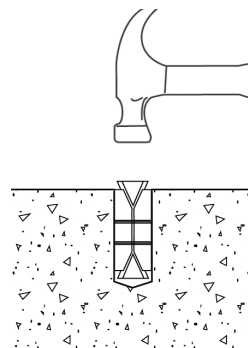


Installation Guidelines

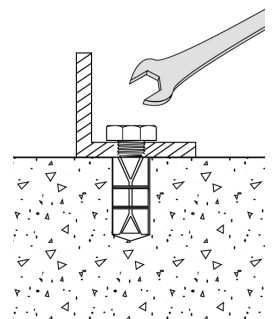
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



Insert anchor into the hole, threaded cone end first until the outer sleeve is flush with the surface of the base material.



Position fixture, then insert screw or bolt and tighten. For maximum expansion, the upper cone should protrude slightly before setting. The bolt must engage a minimum of 2/3 of the anchor threads.



PERFORMANCE DATA

Ultimate Load Capacities for Double Expansion Anchor in Normal-Weight Concrete^{1,2}

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	710 (3.2)	1,110 (5.0)	900 (4.0)	1,135 (5.2)	1,220 (5.5)	1,335 (6.0)
5/16 (7.9)	1 1/2 (38.1)	1,130 (5.1)	1,735 (7.8)	1,500 (6.7)	2,020 (9.1)	2,160 (9.7)	2,155 (9.7)
3/8 (9.5)	1 3/4 (44.5)	1,365 (6.1)	2,690 (12.1)	2,000 (9.0)	3,000 (13.5)	3,085 (13.9)	4,030 (18.1)
1/2 (12.7)	2 1/4 (57.2)	2,590 (11.7)	3,740 (16.8)	3,550 (16.0)	4,310 (19.4)	4,645 (20.9)	6,930 (31.2)
5/8 (15.9)	2 1/2 (63.5)	4,290 (19.3)	9,640 (43.4)	6,150 (27.7)	10,270 (46.2)	6,890 (81.0)	11,580 (52.2)
3/4 (19.1)	3 1/2 (88.9)	6,000 (27.0)	10,920 (49.2)	8,150 (36.7)	13,330 (60.0)	11,510 (51.8)	14,480 (65.2)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.

2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Double Expansion Anchor in Normal-Weight Concrete^{1,2,3}

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		4,000 psi (27.6 MPa)		6,000 psi (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	180 (0.8)	280 (1.3)	225 (1.0)	285 (1.3)	305 (1.4)	335 (1.5)
5/16 (7.9)	1 1/2 (38.1)	285 (1.3)	435 (2.0)	375 (1.7)	505 (2.3)	540 (2.4)	540 (2.4)
3/8 (9.5)	1 3/4 (44.5)	340 (1.5)	675 (3.0)	500 (2.3)	750 (3.4)	770 (3.5)	1,010 (4.5)
1/2 (12.7)	2 1/4 (57.2)	650 (2.9)	935 (4.2)	890 (4.0)	1,080 (4.9)	1,160 (5.2)	1,735 (7.8)
5/8 (15.9)	2 1/2 (63.5)	1,075 (4.8)	2,410 (10.9)	1,540 (6.9)	2,570 (11.6)	1,725 (20.3)	2,895 (13.1)
3/4 (19.1)	3 1/2 (88.9)	1,500 (6.8)	2,730 (12.3)	2,040 (9.2)	3,335 (15.0)	2,880 (13.0)	3,620 (16.3)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Double Expansion Anchor in Hollow Concrete Masonry^{1,2,3}

Rod/Anchor Diameter <i>d</i> in. (mm)	Minimum Embedment Depth <i>h_v</i> in. (mm)	<i>f'_m</i> ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	885 (4.0)	1,350 (6.1)	175 (0.8)	270 (1.2)
5/16 (7.9)	1 1/2 (38.1)	1,295 (5.8)	1,635 (7.4)	260 (1.2)	325 (1.5)
3/8 (9.5)	1 1/2 (38.1)	1,575 (7.1)	2,160 (9.7)	315 (1.4)	430 (1.9)
1/2 (12.7)	1 1/2 (38.1)	2,710 (12.2)	3,130 (14.1)	540 (2.4)	625 (2.8)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation (*f'_m* ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and 1/2" installed in hollow concrete masonry units are limited to one anchor per unit cell.

Ultimate and Allowable Load Capacities for Double Shell Expansion Anchor in Clay Brick Masonry^{1,2}

Rod/Anchor Diameter <i>d</i> in. (mm)	Minimum Embedment Depth <i>h_v</i> in. (mm)	Structural Brick Masonry <i>f'_m</i> ≥ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,175 (5.3)	1,585 (7.1)	235 (1.1)	315 (1.4)
5/16 (7.9)	1 1/2 (38.1)	1,585 (7.1)	2,040 (9.2)	315 (1.4)	410 (1.8)
3/8 (9.5)	1 3/4 (44.5)	1,830 (8.2)	3,590 (16.2)	365 (1.6)	720 (3.2)
1/2 (12.7)	2 1/4 (57.2)	3,420 (15.4)	5,185 (23.3)	685 (3.1)	1,035 (4.7)
5/8 (15.9)	2 1/2 (63.5)	4,460 (19.8)	6,055 (27.2)	890 (4.0)	1,210 (5.4)
3/4 (19.1)	3 1/2 (88.9)	6,000 (26.7)	7,935 (35.7)	1,200 (5.3)	1,585 (7.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation (*f'_m* ≥ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n} \right) + \left(\frac{V_u}{V_n} \right) \leq 1$$

Where: *N_u* = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances¹

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (<i>s</i>)	Tension and Shear	<i>s_{cr}</i> = 10 <i>d</i>	<i>F_{NS}</i> = <i>F_{VS}</i> = 1.0	<i>s_{min}</i> = 5 <i>d</i>	<i>F_{NS}</i> = <i>F_{VC}</i> = 0.50
Edge Distance (<i>c</i>)	Tension	<i>c_{cr}</i> = 12 <i>d</i>	<i>F_{NC}</i> = 1.0	<i>c_{min}</i> = 5 <i>d</i>	<i>F_{NC}</i> = 0.80
	Shear	<i>c_{cr}</i> = 12 <i>d</i>	<i>F_{VC}</i> = 1.0	<i>c_{min}</i> = 5 <i>d</i>	<i>F_{VC}</i> = 0.50

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

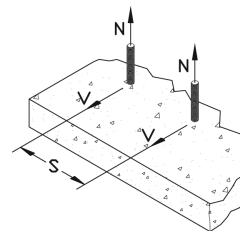
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DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

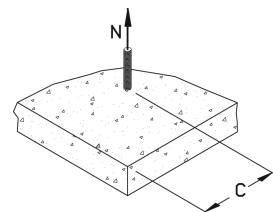
Spacing, Tension (F_{Nc}) & Shear (F_{Vc})						
Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
s_{cr} (in.)	2 1/2	3 1/8	3 3/4	5	6 1/4	7 1/2
s_{min} (in.)	1 1/4	1 9/16	1 7/8	2 1/2	3 1/8	3 3/4
Spacing, s (inches)	1 1/4	0.50				
	1 9/16	0.63	0.50			
	1 7/8	0.75	0.60	0.50		
	2 1/2	1.00	0.80	0.67	0.50	
	3 1/8		1.00	0.83	0.63	0.50
	3 3/4			1.00	0.75	0.60
	5				1.00	0.80
	6 1/4					0.67
	7 1/2					0.83

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters ($10d$) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 50% of load.



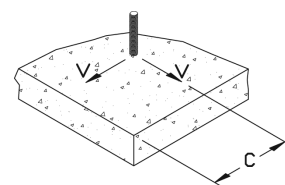
Edge Distance, Tension (F_{Nc})						
Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)	2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.80				
	2 1/2	0.90	0.80			
	3	1.00	0.88	0.80		
	3 3/4		1.00	0.90		
	4			0.93	0.80	
	4 1/2			1.00	0.85	
	5				0.90	0.80
	6				1.00	0.88
	7 1/2					0.90

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_{Vc})						
Dia. (in.)	1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)	3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)	2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.50				
	2 1/2	0.75	0.50			
	3	1.00	0.70	0.50		
	3 3/4		1.00	0.75		
	4			0.83	0.50	
	4 1/2			1.00	0.63	
	5				0.75	0.50
	6				1.00	0.70
	7 1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 8 anchor diameters ($8d$) at which the anchor achieves 50% of load.



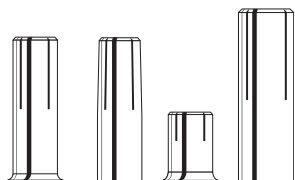
ORDERING INFORMATION

Double Expansion Anchor

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Minimum Hole Depth	Standard Box	Standard Carton	Wt./100
9510	1/4"	1/2"	1 3/8"	1 1/4"	50	500	4
9515	5/16"	5/8"	1 5/8"	1 1/2"	50	500	7 1/2
9520	3/8"	3/4"	2"	1 3/4"	50	250	12 1/2
9525	1/2"	7/8"	2 1/2"	2 1/4"	25	250	18
9530	5/8"	1"	2 3/4"	2 1/2"	25	100	25 1/2
9535	3/4"	1 1/4"	3 15/16"	3 1/2"	10	50	54 1/2



Multi-Set II®



SPECIFIED FOR ANCHORAGE INTO CONCRETE

Drop-In, shell-type anchors feature an internally threaded, all-steel shell with expansion cone insert and flush

embedment lip. "Anchors are manufactured from zinc-plated carbon steel, 18-8 stainless steel and 316 stainless steel.

Anchors should be installed with carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994 specifications.

Anchors should be tested to ASTM E488 criteria and listed by ICC (formerly ICBO). Anchors should also be listed by the following agencies as required by the local building code: UL, FM, City of Los Angeles, California State Fire Marshal and Cal Trans.

APPROVALS/LISTINGS

Meets or exceeds U.S. Government G.S.A. Specification A-A-55614 Type 1
 (Formerly GSA: FF-S-325 Group VIII)

Underwriters Laboratories

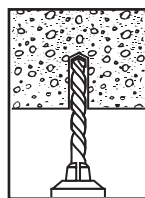
Factory Mutual

City of Los Angeles – #RR2748

California State Fire Marshal

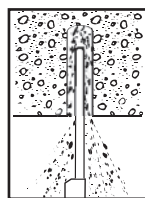
Caltrans

INSTALLATION STEPS

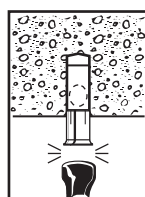


To set anchor flush with surface:

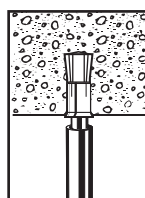
1. Drill hole to required embedment
 (see Table on page 73).



2. Clean hole with pressurized air.



3. Drive anchor flush with surface of concrete.



4. Expand anchor with setting tool provided
 (see chart). Anchor is properly expanded
 when shoulder of setting tool is flush with
 top of anchor.

To set anchor below surface:

Drill hole deeper than anchor length. Thread bolt into anchor.
 Hammer anchor into hole until bolt head is at desired depth.
 Remove bolt and set anchor with setting tool.

Multi-Set II Drop-In Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Concrete*

BOLT DIA. In. (mm)	ANCHOR DIA. In. (mm)	MIN. EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	TENSION Lbs. (kN)			SHEAR Lbs. (kN)
				f'c = 2000 PSI (13.8 MPa)	f'c = 4000 PSI (27.6 MPa)	f'c = 6000 PSI (41.4 MPa)	f'c > 2000 PSI (13.8 MPa)
1/4 (6.4)	3/8 (9.5)	1 (25.4)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	1,680 (7.5)	2,360 (10.5)	2,980 (13.3)	1,080 (4.8)
3/8 (9.5)	1/2 (12.7)	1-5/8 (41.3)		2,980 (13.3)	3,800 (16.9)	6,240 (27.8)	3,160 (14.1)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		3,300 (14.7)	5,840 (26.0)	8,300 (36.9)	4,580 (20.4)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		5,500 (24.5)	8,640 (38.4)	11,020 (49.0)	7,440 (33.1)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		8,280 (36.8)	9,480 (42.2)	12,260 (54.5)	10,480 (46.6)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

* For continuous extreme low temperature applications, use stainless steel.

Combined Tension and Shear Loading—for Multi-Set Anchors

Allowable loads for anchors subjected to combined shear and tension forces are determined by the following equation:

$$(P_s/P_t)^{2/3} + (V_s/V_t)^{2/3} \leq 1$$

P_s = Applied tension load

V_s = Applied shear load

P_t = Allowable tension load

V_t = Allowable shear load

Multi-Set II Drop-In Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Lightweight Concrete*

BOLT DIA. In. (mm)	ANCHOR DIA. In. (mm)	MINIMUM EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	LIGHTWEIGHT CONCRETE f'c = 3000 PSI (20.7 MPa)		LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL f'c = 3000 PSI (20.7 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	1/2 (12.7)	1-5/8 (39.7)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	2,035 (9.1)	1,895 (8.4)	3,340 (14.9)	4,420 (19.6)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		2,740 (12.2)	2,750 (12.2)	3,200 (14.2)	4,940 (22.0)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		4,240 (18.9)	4,465 (19.9)	5,960 (26.5)	5,840 (26.0)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		5,330 (23.7)	6,290 (28.0)	8,180 (36.4)	9,120 (40.6)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

Multi-Set II Drop-In Anchors

Recommended Edge and Spacing Distance Requirements*

BOLT DIA. In. (mm)	DRILL BIT SIZE In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. EDGE DISTANCE AT WHICH LOAD FACTOR APPLIED =.80 FOR TENSION =.70 FOR SHEAR In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING BETWEEN ANCHORS LOAD FACTOR APPLIED =.80 FOR TENSION =.55 FOR SHEAR In. (mm)
1/4 (6.4)	3/8 (9.5)	1 (25.4)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	1-3/4 (44.5)	7/8 (22.2)	3-1/2 (88.9)	1-3/4 (44.5)
3/8 (9.5)	1/2 (12.7)	1-5/8 (41.3)		2-7/8 (73.0)	1-7/16 (36.5)	5-11/16 (144.5)	2-7/8 (73.0)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		3-1/2 (88.9)	1-3/4 (44.5)	7 (177.8)	3-1/2 (88.9)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		4-3/8 (111.1)	2-3/16 (55.6)	8-3/4 (222.3)	4-3/8 (111.1)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		5-5/8 (142.9)	2-13/16 (71.4)	11-3/16 (284.2)	5-5/8 (142.9)

* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Multi-Set II Drop-In Anchors

Ultimate Tension and Shear Values (Lbs/kN) for RX-series (3/4" and 1" Embedment)*

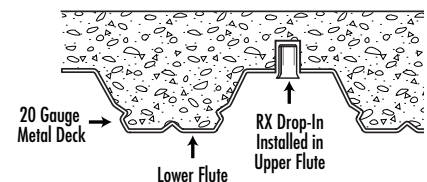
BOLT DIA. In. (mm)	DRILL BIT SIZE In. (mm)	EMBEDMENT In. (mm)	2500 PSI (17.2 MPa) CONCRETE		4000 PSI (27.6 MPa) CONCRETE		HOLLOW CORE	
			TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	1/2 (12.7)	3/4 (19.1)	1,571 (7.0)	2,295 (10.2)	1,987 (8.8)	2,903 (12.9)	1,908 (8.5)	2,401 (10.7)
1/2 (12.7)	5/8 (15.9)	1 (25.4)	2,113 (9.4)	2,585 (11.5)	2,673 (11.9)	3,270 (14.5)	2,462 (11.0)	2,401 (10.7)

* The tabulated values are for RX anchors installed at a minimum of 12 diameters on center and minimum edge distance of 6 diameters for 100 percent anchor efficiency. Spacing and edge distance may be reduced to 6 diameters spacing and 3 diameter edge distance provided the values are reduced 50 percent. Linear Interpolation may be used for intermediate spacings and edge margins.

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

Multi-Set II Drop-In Anchors

Anchoring Overhead in 3000 PSI Lightweight Concrete On Metal Deck



ANCHOR	DRILL HOLE DIAMETER In. (mm)	EMBEDMENT In. (mm)	3000PSI (20.7 MPa) CONCRETE			
			ULTIMATE TENSION LOAD Lbs. (kN)		ALLOWABLE WORKING LOAD Lbs. (kN)	
RX-38 Drop-In	1/2 (12.7)	3/4 (19.1)	Upper Flute	1,410 (6.3)	353 (1.6)	
			Lower Flute	1,206 (5.4)	301 (1.3)	

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

BOLTS

FIG. 780

HEX HEAD MACHINE BOLT

MATERIAL: Carbon steel or
FINISH: electro galvanized.
SERVICE: For use as a fastening device.
ORDERING: Specify size, figure number and finish. Length of bolt is measured from under the head to the extreme point. Sizes as shown are carried in stock, other sizes are also available.

DIAMETER OF BOLT	WEIGHT PER HUNDRED, LBS.														
	LENGTH OF BOLT IN INCHES														
	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4½	5	5½	6
¾	9	10	11	—	—	—	—	—	—	—	—	—	—	—	—
½	18	20	21	22	24	25	27	—	—	—	—	—	—	—	—
⅜	31	33	35	37	39	41	43	46	48	50	52	56	61	65	69
¼	49	52	55	58	61	64	67	70	73	76	80	86	92	98	105
⅞	—	—	—	—	89	93	98	102	106	110	115	123	131	140	148
1	—	—	—	—	—	128	134	139	145	150	156	167	178	189	200
1⅛	—	—	—	—	—	—	—	—	193	—	207	221	235	249	263
1¼	—	—	—	—	—	—	—	—	—	—	—	—	302	320	337

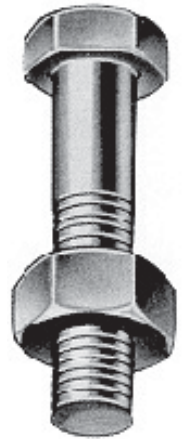


FIG. 785

STANDARD HEX NUTS

FIG. 790

HEAVY DUTY HEX NUTS

MATERIAL: Carbon steel or 3
FINISH: E , electro galvanized.
ORDERING: Specify rod size, figure number and finish.

ROD SIZE	WEIGHT PER 100, LBS.	
	FIG. 785	FIG. 790
¼	0.74	1.2
⅜	1.60	3.2
½	3.75	6.6
⅝	7.33	12
¾	11.9	19
⅞	19.0	30
1	28.3	43
1⅛	40.3	59
1¼	54.3	79
1⅜	73.0	102
1½	94.3	131

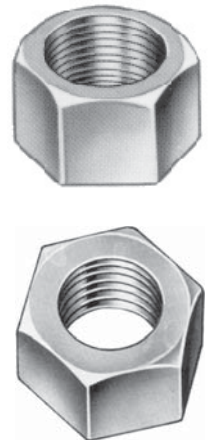
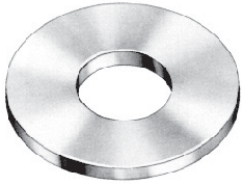


FIG. 795

ROUND STEEL WASHERS



MATERIAL: Carbon steel or
FINISH: electro
ORDERING: Specify rod size, figure number and finish.

SIZE OF BOLT	OUTSIDE DIAMETER	DIAMETER OF HOLE	WEIGHT PER 100, LBS.
$\frac{1}{4}$	$\frac{3}{4}$	$\frac{5}{16}$	0.67
$\frac{3}{8}$	1	$\frac{7}{16}$	1.50
$\frac{1}{2}$	$1\frac{3}{8}$	$\frac{9}{16}$	3.90
$\frac{5}{8}$	$1\frac{3}{4}$	$\frac{11}{16}$	7.80
$\frac{3}{4}$	2	$\frac{13}{16}$	11.00
$\frac{7}{8}$	$2\frac{1}{4}$	$\frac{15}{16}$	15.00
1	$2\frac{1}{2}$	$1\frac{1}{16}$	19.00
$1\frac{1}{8}$	$2\frac{3}{4}$	$1\frac{1}{4}$	22.00
$1\frac{1}{4}$	3	$1\frac{3}{8}$	26.00
$1\frac{1}{2}$	$3\frac{1}{2}$	$1\frac{5}{8}$	38.00

FIG. 800

LOCK WASHER



MATERIAL: Carbon steel
FINISH: electro-galvanized.
ORDERING: Specify size, figure number and finish.

ROD SIZE	INSIDE DIAMETER	WIDTH OF STEEL	THICKNESS OF STEEL	WEIGHT PER 100, LBS.
$\frac{3}{8}$	$\frac{7}{16}$	.141	.094	7
$\frac{1}{2}$	$\frac{9}{16}$	.171	.125	15
$\frac{5}{8}$	$\frac{11}{16}$	.203	.156	26
$\frac{3}{4}$	$\frac{13}{16}$	.234	.188	43

FIG. 805

STEEL WASHER PLATE



MATERIAL: Carbon steel
FINISH: electro or galvanized.
SERVICE: For use as a heavy duty washer to suspend hanger rods.
ORDERING: Specify rod tapping size, figure number and finish.

ROD SIZE	WEIGHT PER 100, LBS.	SIZE OF STOCK
$\frac{3}{8}$	62	3 x 3 x $\frac{1}{4}$
$\frac{1}{2}$	62	3 x 3 x $\frac{1}{4}$
$\frac{5}{8}$	92	3 x 3 x $\frac{3}{8}$
$\frac{3}{4}$	164	4 x 4 x $\frac{3}{8}$
$\frac{7}{8}$	220	4 x 4 x $\frac{1}{2}$
1	220	4 x 4 x $\frac{1}{2}$

FIG. 755**CONTINUOUS THREADED ROD**

MATERIAL: Carbon steel

FINISH: electro or galvanized.

SERVICE: For use in applications for attaching hangers to structural attachments. Continuous threaded rod can be cut to required lengths. Sizes below are stocked in 6', 10' and 12' lengths. SAE national fine thread can be furnished to order.

ORDERING: Specify rod diameter, figure number, length and finish.

ROD SIZE	WEIGHT PER 100, LBS.	MAX. REC. LOAD, LBS.
1/4	12	240
5/16	20	300
3/8	30	610
1/2	54	1130
5/8	85	1810
3/4	120	2710
7/8	170	3770
1	225	4960
1 1/8	280	6230
1 1/4	350	8000
1 3/8	450	9000
1 1/2	500	11630

**FIG. 760****HANGER ROD**

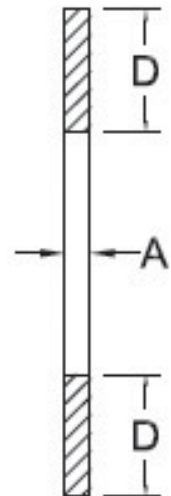
MATERIAL: Carbon steel or

FINISH: electro galvanized.

SERVICE: For use in applications for attaching hangers to structural attachments. Threaded on both ends and can be furnished in standard lengths of 8" - 240"

ORDERING: Specify rod diameter, figure number, length, thread length and finish.

ROD SIZE A	STANDARD ROD THREAD LENGTH D, IN.	MAX. REC. LOAD, LBS. 650° F
1/4	2 1/2	240
3/8	2 1/2	610
1/2	2 1/2	1130
5/8	2 1/2	1810
3/4	3	2710
7/8	3 1/2	3770
1	4	4960



Tapcon® Concrete and Masonry Anchors



SPECIFIED FOR ANCHORAGE INTO CONCRETE, BRICK OR BLOCK

The "original masonry" anchor that cuts its own threads into concrete, brick, or block. Maximum performance is achieved because the Tapcon Anchor, the Condrive Installation Tool, and the carbide-tipped Tapcon Drill Bits are designed to work as a system. It is essential to use the Condrive tool and the correct drill bit to assure consistent anchor performance.

Now available in 410 stainless steel.

APPROVALS/LISTINGS

ICC Evaluation Service, Inc. — #ESR-1671

ICC Evaluation Service, Inc. — #ESR-2202

Miami-Dade County — #07-0315.03

Florida Building Code



Hex Head style on Tapcon Anchors is available for majority of fixture anchoring needs

Climaseal® Coating is standard on all Tapcon anchors to provide extended corrosion resistance

Now available in 410 Stainless Steel



Phillips Flat Head style is available when flush seating is necessary in countersink applications

Advanced Threadform cuts into masonry materials for greater pullout values

Lengths of Tapcon Anchors range from 1-1/4" to 4" in 3/16" and up to 6" in 1/4" diameters.

Nail-Type Point guides the anchor into the pre-drilled hole. Excellent for wood to concrete applications

INSTALLATION STEPS

Read instructions before using (installation)!



WARNING:

If there are any questions concerning proper installation, applications or appropriate use of this product, please call our Technical Services Department at 1-800-899-7890. Failure to follow these instructions can result in serious personal injury.

1. **Select proper fastener – diameter / head style / length**
 - a) **Use selection chart to choose proper length.**
2. **Drill Hole – use selection chart to determine drill bit length and depth of hole**
 - a) **Choose appropriate drill bit based upon diameter of Tapcon Anchor.**
 - b) **Drill hole minimum 7" deeper than Tapcon Anchor to be embedded.**

Minimum anchor embedment: 1"

Maximum anchor embedment: 1-3/4"

3. Drive Anchor



WARNING:

Failure to wear safety glasses with side shields can result in serious personal injury. Always wear ANSI compliant eye protection (ANSI Z87.1-2003).



WARNING:

Using the wrong size drill bit will affect performance values and may cause failure.

Head Styles

3/16" diameter has a 1/4" slotted hex washer head (HWH)
 1/4" diameter has a 5/16" slotted hex washer head (HWH)



3/16" diameter uses a #2 phillips flat head (PFH)
 1/4" diameter uses a #3 phillips flat head (PFH)



PERFORMANCE TABLE

Tapcon Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Concrete

ANCHOR DIA. In. (mm)	MIN. DEPTH OF EMBEDMENT In. (mm)	f'c = 2000 PSI (13.8 MPa)		f'c = 3000 PSI (20.7 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 5000 PSI (34.5 MPa)	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	600 (2.7)	720 (3.2)	625 (2.8)	720 (3.2)	650 (2.9)	720 (3.2)	800 (3.6)	860 (3.8)
	1-1/4 (31.8)	845 (3.7)	720 (3.2)	858 (3.8)	720 (3.2)	870 (3.9)	720 (3.2)	1,010 (4.5)	860 (3.8)
	1-1/2 (38.1)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,220 (5.4)	860 (3.8)
	1-3/4 (44.5)	1,450 (6.5)	870 (3.9)	1,455 (6.5)	870 (3.9)	1,460 (6.5)	990 (4.4)	1,730 (7.7)	990 (4.4)
1/4 (6.4)	1 (25.4)	750 (3.3)	900 (4.0)	775 (3.4)	900 (4.0)	800 (3.6)	1,360 (6.1)	950 (4.2)	1,440 (6.4)
	1-1/4 (31.8)	1,050 (4.7)	900 (4.0)	1,160 (5.2)	900 (4.0)	1,270 (5.6)	1,360 (6.1)	1,515 (6.7)	1,440 (6.4)
	1-1/2 (38.1)	1,380 (6.1)	1,200 (5.3)	1,600 (7.2)	1,200 (5.3)	1,820 (8.1)	1,380 (6.1)	2,170 (9.7)	1,670 (7.4)
	1-3/4 (44.5)	2,020 (9.0)	1,670 (7.4)	2,200 (9.8)	1,670 (7.4)	2,380 (10.6)	1,670 (7.4)	2,770 (12.3)	1,670 (7.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

PERFORMANCE TABLE

Tapcon Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Hollow Block

ANCHOR DIA. In. (mm)	ANCHOR EMBEDMENT In. (mm)	LIGHTWEIGHT BLOCK		MEDIUM WEIGHT BLOCK	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	220 (1.0)	400 (1.8)	340 (1.5)	730 (3.2)
1/4 (6.4)	1 (25.4)	250 (1.1)	620 (2.8)	500 (2.2)	1,000 (4.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

NOTE: 3/16" Tapcon requires 5/32" bit, 1/4" Tapcon requires 3/16" bit.

PERFORMANCE TABLE

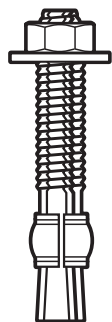
Tapcon® Anchors

Allowable Edge and Spacing Distances

PARAMETER	ANCHOR DIA. Inch	NORMAL WEIGHT CONCRETE			CONCRETE MASONRY UNITS (CMU)		
		FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR	FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR
Spacing Between Anchors - Tension	3/16	3	1-1/2	0.73	3	1-1/2	1.00
	1/4	4	2	0.66	4	2	0.84
Spacing Between Anchors - Shear	3/16	3	1-1/2	0.83	3	1-1/2	1.00
	1/4	4	2	0.82	4	2	0.81
Edge Distance - Tension	3/16	1-7/8	1	0.71	4	2	0.91
	1/4	2-1/2	1-1/4	0.78	4	2	0.88
Edge Distance - Shear	3/16	2-1/4	1-1/8	0.70	4	2	0.93
	1/4	3	1-1/2	0.59	4	2	0.80

For SI: 1 inch = 25.4 mm

Trubolt Wedge



SPECIFIED FOR ANCHORAGE INTO CONCRETE

Trubolt Wedge anchors feature a stainless steel expansion clip, threaded stud body, nut and washer. Anchor bodies are made of plated carbon steel, hot-dipped galvanized carbon steel, type 304 stainless steel or type 316 stainless steel as identified in the drawings or other notations.

Trubolt+ Wedge anchors consist of a high-strength threaded stud body, expansion clip, nut and washer. Anchor bodies are made of plated carbon steel. The expansion clip consists of a split cylindrical ring with undercutting grooves.

The exposed end of the anchor is stamped to identify anchor length. Stampings should be preserved during installation for any subsequent embedment verification.

Use carbide tipped hammer drill bits made in accordance with ANSI B212.15-1994 to install anchors.

Anchors are tested to ACI 355.2 and ICC-ES AC193. Anchors are listed by the following agencies as required by the local building code: ICC-ES, UL, FM, City of Los Angeles, California State Fire Marshal and Caltrans.

APPROVALS/LISTINGS

Trubolt®

Wedge Anchors

ICC Evaluation Service, Inc. # ESR-2251

- Category 1 performance rating
- 2006 IBC compliant
- Meets ACI 318 ductility requirements
- Tested in accordance with ACI 355.2 and ICC-ES AC193
- For use in seismic zones A & B
- 1/4", 3/8" & 1/2" diameter anchors listed in ESR-2251

Underwriters Laboratories

Factory Mutual

City of Los Angeles - #RR2748

California State Fire Marshal

Caltrans

Meets or exceeds U.S. Government G.S.A. Specification A-A-1923A Type 4 (formerly GSA: FF-S-325 Group II, Type 4, Class 1)

Trubolt+®

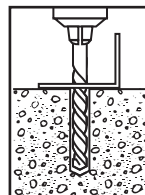
Seismic Wedge Anchors

ICC Evaluation Service, Inc. # ESR-2427

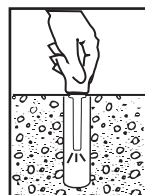
- Category 1 performance rating
- 2006 IBC and 2009 IBC compliant
- Meets ACI 318 ductility requirements
- Tested in accordance with ACI 355.2 and ICC-ES AC193
- Listed for use in seismic zones A, B, C, D, E, & F
- 3/8", 1/2", 5/8" & 3/4" diameter anchors listed in ESR-2427

City of Los Angeles - #RR25867

INSTALLATION STEPS



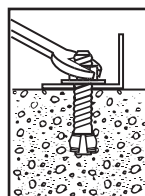
1. Select a carbide drill bit with a diameter equal to the anchor diameter. Drill hole to any depth exceeding the desired embedment. See chart for minimum recommended embedment.



2. Clean hole or continue drilling additional depth to accommodate drill fines.



3. Assemble washer and nut, leaving nut flush with end of anchor to protect threads. Drive anchor through material to be fastened until washer is flush to surface of material.

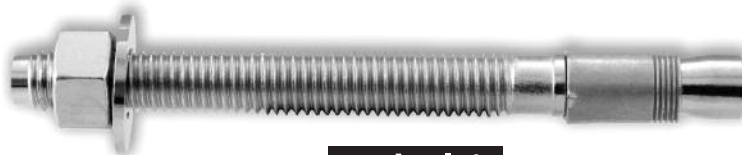


4. Expand anchor by tightening nut 3-5 turns past the hand tight position, or to the specified torque requirement.

LENGTH INDICATION CODE *

CODE	LENGTH OF ANCHOR		CODE	LENGTH OF ANCHOR	
A	1-1/2 < 2	(38.1 < 50.8)	K	6-1/2 < 7	(165.1 < 177.8)
B	2 < 2-1/2	(50.8 < 63.5)	L	7 < 7-1/2	(177.8 < 190.5)
C	2-1/2 < 3	(63.5 < 76.2)	M	7-1/2 < 8	(190.5 < 203.2)
D	3 < 3-1/2	(76.2 < 88.9)	N	8 < 8-1/2	(203.2 < 215.9)
E	3-1/2 < 4	(88.9 < 101.6)	O	8-1/2 < 9	(215.9 < 228.6)
F	4 < 4-1/2	(101.6 < 114.3)	P	9 < 9-1/2	(228.6 < 241.3)
G	4-1/2 < 5	(114.3 < 127.0)	Q	9-1/2 < 10	(241.3 < 254.0)
H	5 < 5-1/2	(127.0 < 139.7)	R	10 < 11	(254.0 < 279.4)
I	5-1/2 < 6	(139.7 < 152.4)	S	11 < 12	(279.4 < 304.8)
J	6 < 6-1/2	(152.4 < 165.1)	T	12 < 13	(304.8 < 330.2)

*Located on top of anchor for easy inspection.



Trubolt+®
Seismic Wedge Anchors

APPENDIX C: Strength Design Performance values in accordance to 2006 and 2009 IBC

ITW RED HEAD TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION TESTED TO ICC-ES AC 193

AND ACI 355.2, IN ACCORDANCE WITH 2006 and 2009 IBC



TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION¹

Characteristic	Symbol	Units	Nominal Anchor Diameter (inch) ⁴									
			3/8"		1/2"				5/8"		3/4"	
Anchor category	1, 2 or 3	—	1		1				1		1	
Minimum effective embedment depth	h_{ef}	in	1-5/8		2		3-1/4		2-3/4	4-1/4	3-3/4	
Minimum concrete member thickness	h_{min}	in	4	5	4	6	6	8	6	6-1/4	7	8
Critical edge distance	c_{ac}	in	5	3	6	6	7-1/2	6	7-1/2	6-1/2	12	10
Data for Steel Strengths – Tension and Shear												
Minimum specified yield strength	f_y	psi	60,000		55,000				55,000		55,000	
Minimum specified ultimate strength	f_{uta}	psi	75,000		75,000				75,000		75,000	
Effective tensile stress area (neck)	A_{se}	in ²	0.056		0.119				0.183		0.266	
Effective tensile stress area (thread)	A_{se}	in ²	0.075		0.142				0.217		0.332	
Steel strength in tension	N_{sa}	lbf	4,200		8,925				13,725		19,950	
Steel strength in shear, uncracked or cracked concrete ⁶	V_{sa}	lbf	1,830		5,175				8,955		14,970	
Steel strength in shear – seismic loads	V_{eq}	lbf	1,545		5,175				8,955		11,775	
Strength reduction factor f for tension, steel failure modes ²			0.75		0.75				0.75		0.75	
Strength reduction factor f for shear, steel failure modes ²			0.60		0.65				0.65		0.65	
Data for Concrete Breakout Concrete Pryout Strengths in Tension and Shear												
Effectiveness factor – uncracked concrete	k_{uncr}	—	24		24				24		24	
Effectiveness factor – cracked concrete	k_{cr}	—	17		17				17		17	
Modification factor for cracked and uncracked concrete ³	$\Psi_{C,N}$	—	1.0		1.0				1.0		1.0	
Coefficient for pryout strength	k_{cp}	—	1.0		1.0		2.0		2.0		2.0	
Load-bearing length of anchor	l_e	in	1.625		2.0		3.25		2.75	4.25	3.75	
Strength reduction factor ϕ for tension, concrete failure modes, Condition B ²			0.65		0.65				0.65		0.65	
Strength reduction factor ϕ for shear, concrete failure modes, Condition B ²			0.70		0.70				0.70		0.70	
Data for Pullout Strengths												
Pullout strength, uncracked concrete	$N_{p,uncr}$	lbf	See Footnote ⁵		See Footnote ⁵		6,540		5,430	8,900	See Footnote ⁵	
Pullout strength, cracked concrete	$N_{p,cr}$	lbf	See Footnote ⁵		See Footnote ⁵				See Footnote ⁵		See Footnote ⁵	
Pullout strength for seismic loads	N_{eq}	lbf	See Footnote ⁵		See Footnote ⁵				See Footnote ⁵	6,715	See Footnote ⁵	
Strength reduction factor f for tension, pullout failure modes, Condition B ²			See Footnote ⁵		0.65				0.65		See Footnote ⁵	
Additional Anchor Data												
Axial stiffness in service load range in uncracked concrete	b_{uncr}	lbf/in	100,000		250,000				250,000		250,000	
Axial stiffness in service load range in cracked concrete	b_{cr}	lbf/in	40,000		20,000				20,000		20,000	

For SI: 1 inch = 25.4 mm, 1 in² = 645.16mm², 1 lbf = 4.45 N, 1 psi = 0.006895 MPa, 1 lbf • 102/in = 17,500 N/m.

¹ The 1/2", 5/8" and 3/4" diameter Trubolt+ Wedge Anchors are ductile steel elements as defined by ACI 318 D.1. The 3/8" diameter Trubolt+ is considered ductile under tension loading and brittle under shear loading.

² All values of ϕ apply to the load combinations of IBC Section 1605.2, ACI 318 Section 9.2 or UBC Section 1612.2. If the load combinations of Appendix C or UBC Section 1909.2 are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For installations where reinforcement that complies with ACI 318 Appendix D requirements for Condition A is present, the appropriate ϕ factor must be determined in accordance with ACI 318 D.4.4.

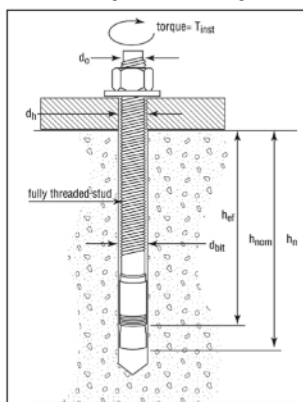
³ For all design cases $\Psi_{CN} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.

⁴ The actual diameter for the 3/8" diameter anchor is 0.361" for the 5/8" diameter anchor is 0.615" and the 3/4" diameter anchor is 0.7482".

⁵ Anchor pullout strength does not control anchor design. Determine steel and concrete capacity only.

⁶ Steel strength in shear values are based on test results per ACI 355.2, Section 9.4 and must be used for design.

TRUBOLT+ WEDGE ANCHOR (INSTALLED)



TRUBOLT+ WEDGE INSTALLATION INFORMATION

Parameter	Notation	Units	Nominal Achor Diameter (inch)									
			3/8		1/2				5/8		3/4	
Anchor outer diameter	d _o	inches	0.361		0.5				0.615		0.7482	
Nominal carbide bit diameter	d _{bit}	inches	3/8		1/2				5/8		3/4	
Effective embedment depth	h _{ef}	inches	1-5/8		2		3-1/4		2-3/4	4-1/4	3-3/4	
Minimum anchor embedment depth	h _{nom}	inches	2		2-1/2		3-3/4		3-1/4	4-3/4	4-3/8	
Minimum hole depth ¹	h _o	inches	2-1/4		2-3/4		4		3-1/2	5	4-5/8	
Minimum concrete member thickness ¹	h _{min}	inches	4	5	4	6	6	8	6	6-1/4	7	8
Critical edge distance ¹	c _{ac}	In.	5	3	6	6	7-1/2	6	7-1/2	6-1/2	12	10
Minimum anchor spacing ¹	s _{min}	In.	3-1/2	2-1/2	6	5-3/4	4	5-3/4	8	6	6	6
Minimum edge distance ¹	c _{min}	In.	3		6				7-1/2	5	7-1/2	7-1/2
Minimum overall anchor length	l	inches	2-1/2		3-3/4		4-1/2		4-1/4	6	5-1/2	
Installation torque	T _{inst}	ft-lb	30		45				90		110	
Minimum diameter of hole in fastened part	d _h	inches	1/2		5/8				3/4		7/8	

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m.



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APPENDIX C: Strength Design Performance values in accordance to 2006 and 2009 IBC

TRUBOLT+ WEDGE ANCHOR ALLOWABLE STRESS DESIGN (ASD) VALUES FOR ILLUSTRATIVE PURPOSES

Anchor Notation	Anchor Embedment Depth (inches), h_{nom}	Effective Embedment Depth (inches), h_{ef}	Allowable Tension Load (lbs)
3/8	2	1-5/8	1,090
1/2	2-1/2	2	1,490
	3-3/4	3-1/4	2,870
5/8	3-1/4	2-3/4	2,385
	4-3/4	4-1/4	3,910
3/4	4-3/8	3-3/4	3,825

For SI: 1 inch = 25.4 mm, 1 ft-lb = 4.45N.

Design Assumptions:

1 Single anchor with static shear load only.

2 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).

3 Thirty percent dead load and 70 percent live load, controlling load combination $1.2D + 1.6L$.

4 Calculation of weighted average: $1.2D + 1.6L = 1.2(0.3) + 1.6(0.7) = 1.48$

5 Values do not include edge distance or spacing reductions.

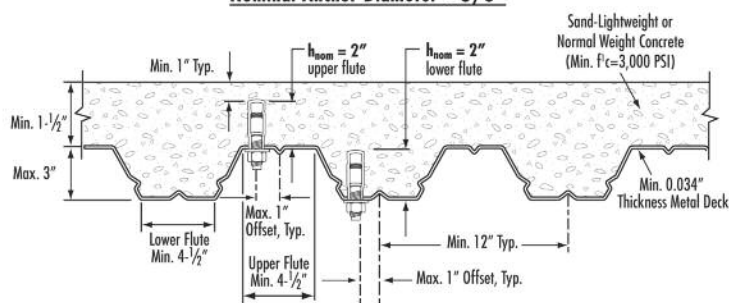
ITW RED HEAD TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION FOR INSTALLATION IN THE SOFFIT OF CONCRETE FILL ON METAL DECK FLOOR AND ROOF ASSEMBLIES

TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION

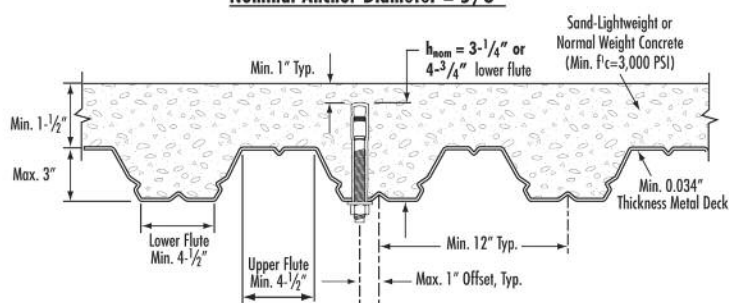
Characteristic	Symbol	Units	Nominal Anchor Diameter				
			3/8"	1/2"	5/8"		
			Upper /Lower	Upper /Lower	Lower Only	Lower Only	Lower Only
			$h_{ef} = 1-5/8"$	$h_{ef} = 2"$	$h_{ef} = 3-1/4"$	$h_{ef} = 2-3/4"$	$h_{ef} = 4-1/4"$
Pullout strength, uncracked concrete over metal deck	$N_{p, deck, uncr}$	lbf	2,170	2,515	5,285	3,365	6,005
Pullout strength, cracked concrete over metal deck	$N_{p, deck, cr}$	lbf	1,650	1,780	4,025	2,405	5,025
Reduction factor for pullout strength in tension, Condition B	ϕ	---	0.65				
Shear strength, uncracked concrete over metal deck	$V_{p, deck, uncr}$	lbf	1,640	2,200	3,790	2,890	6,560
Reduction factor for steel strength in shear	ϕ	---	0.60	0.65			
Anchor embedment depth	h_{nom}	in	2.0	2.5	3.75	3.25	4.75

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N

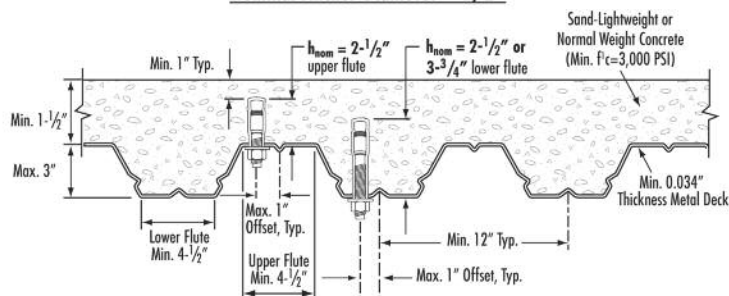
Nominal Anchor Diameter = 3/8"



Nominal Anchor Diameter = 5/8"



Nominal Anchor Diameter = 1/2"



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APPENDIX B: Strength Design Performance values in accordance to 2006 IBC

ITW RED HEAD TRUBOLT WEDGE ANCHOR

DESIGN INFORMATION TESTED TO ICC-ES AC193 AND ACI 355.2, IN ACCORDANCE WITH 2006 IBC

Trubolt®
Wedge Anchors

TRUBOLT WEDGE ANCHOR DESIGN INFORMATION^{1,2,3}

DESIGN INFORMATION	Symbol	Units	Nominal Anchor Diameter									
			1/4		3/8		1/2		5/8		3/4	
Anchor O.D.	d_o	in	0.250		0.375		0.500		0.625		0.750	
Effective embedment	h_{ef}	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Minimum member thickness	h_{min}	in	4	4	4	5	5	6	5	8	6	8
Critical edge distance	c_{ac}	in	2-5/8	3	2-5/8	5-1/4	3-3/4	6-3/4	5	8	7	9
Minimum edge distance	c_{min}	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Minimum anchor spacing	s_{min}	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Min. Specified Yield Strength	f_y	lb/in ²	55,000									
Min. Specified Ultimate Strength	f_{uta}	lb/in ²	75,000									
Effective tensile stress area	A_{se}	in ²	0.032		0.078		0.142		0.226		0.334	
Steel strength in tension	N_s	lb	2,385		5,815		10,645		16,950		25,050	
Steel strength in shear	V_s	lb	1,430		2,975	3,490	4,450	6,385	6,045	10,170	10,990	15,030
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb	1,392	1,706	2,198	3,469	2,400	4,168	4,155	6,638	8,031	10,561
Anchor Category (All anchors are ductile)			1									
Effectiveness factor k_{uncr} , uncracked concrete			24									
Axial stiffness in service load range	β	lb/in	14,651	9,385	17,515	26,424	32,483	26,136	42,899	21,749	43,576	28,697
Coefficient for variation for axial stiffness in service load range			34	47	28	45	17	33	55	22	63	28
Strength reduction factor ϕ for tension, steel failure modes			0.75									
Strength reduction factor ϕ for shear, steel failure modes			0.65									
Strength reduction factor ϕ for tension, concrete failure modes, Condition B			0.65									
Strength reduction factor ϕ for shear, concrete failure modes, Condition B			0.70									

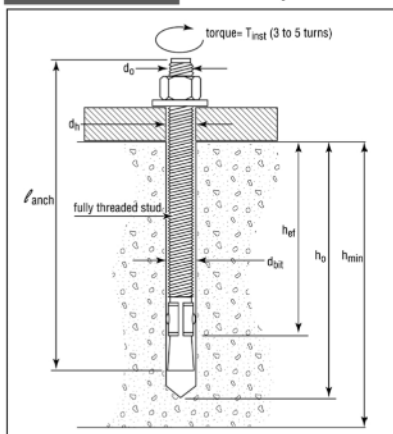
¹ Trubolt+ Anchor Design Strengths must be determined in accordance with ACI 318-05 Appendix D and this table

² The Trubolt+ Wedge Anchor is a ductile steel element as defined by ACI 318 D.1

³ 1/4", 3/8", & 1/2" diameter data is listed in ICC-ES ESR-2251.

Trubolt®
Wedge Anchors

TRUBOLT WEDGE ANCHOR (INSTALLED)



TRUBOLT WEDGE INSTALLATION INFORMATION

	Symbol	Units	Nominal Anchor Diameter (in.)									
			1/4		3/8		1/2		5/8		3/4	
Anchor outer diameter	d_o	in	0.25		0.375		0.5		0.625		0.750	
Nominal carbide bit diameter	d_{bit}	in	1/4		3/8		1/2		5/8		3/4	
Effective embedment depth	h_{ef}	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Min hole depth	h_o	in	2	2-1/2	2-1/2	3-3/8	2-3/4	4-1/4	3-3/4	5-1/4	4-3/4	6
Min slab thickness	h_{min}	in	4		4	5	5	6	5	8	6	8
Installation torque	T_{inst}	ft-lb	4		25		55		90		110	
Min hole diameter in fixture	d_h	in	5/16		7/16		9/16		11/16		13/16	



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APPENDIX B: Strength Design Performance values in accordance to 2006 IBC

Trubolt®
Wedge Anchors

TRUBOLT WEDGE PULLOUT STRENGTH (N_p, unc) (POUNDS) ¹

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		$f'_c = 2,500$ psi	$f'_c = 3,000$ psi	$f'_c = 4,000$ psi	$f'_c = 6,500$ psi
1/4	1-1/2	1,392	1,525	1,610	1,822
	2	1,706	1,869	1,947	2,151
3/8	1-3/4	2,198	2,408	2,621	3,153
	2-5/8	3,469	3,800	3,936	4,275
1/2	1-7/8	2,400	2,629	3,172	4,520
	3-3/8	4,168	4,520	4,520	4,520
5/8	2-1/2	4,155	4,155	4,376	5,578
	4	6,638	6,900	7,968	10,157
3/4	3-1/2	8,031	8,322	9,610	12,251
	4-3/4	10,561	10,561	10,561	12,251

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

¹ Values are for single anchors with no edge distance or spacing reduction.

TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC TENSION (ASD), NORMAL-WEIGHT UNCRACKED CONCRETE ¹⁻⁶

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		$f'_c = 2,500$ psi	$f'_c = 3,000$ psi	$f'_c = 4,000$ psi	$f'_c = 6,500$ psi
1/4	1-1/2	611	670	707	800
	2	749	821	855	945
3/8	1-3/4	965	1,058	1,151	1,385
	2-5/8	1,524	1,669	1,729	1,878
1/2	1-7/8	1,054	1,155	1,393	1,985
	3-3/8	1,831	1,985	1,985	1,985
5/8	2-1/2	1,825	1,825	1,922	2,450
	4	2,915	3,030	3,499	4,461
3/4	3-1/2	3,527	3,655	4,221	5,381
	4-3/4	4,638	4,638	4,638	5,381

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

Design Assumptions:

- ¹ Single anchor with static tension load only.
- ² Concrete determined to remain uncracked for the life of the anchorage.
- ³ Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
- ⁴ Thirty percent dead load and 70 percent live load, controlling load combination $1.2D + 1.6L$.
- ⁵ Calculation of weighted average: $1.2D + 1.6L = 1.2(0.3) + 1.6(0.7) = 1.48$
- ⁶ Values do not include edge distance or spacing reductions.



TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC SHEAR (ASD), STEEL (POUNDS)¹⁻⁵

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Allowable Steel Capacity, Static Shear
1/4	1-1/2	628
	2	
3/8	1-3/4	1,307
	2-5/8	1,533
1/2	1-7/8	1,954
	3-3/8	2,804
5/8	2-1/2	2,655
	4	4,467
3/4	3-1/2	4,827
	4-3/4	6,601

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa

Design Assumptions:

- ¹ Single anchor with static shear load only.
- ³ Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
- ⁴ Thirty percent dead load and 70 percent live load, controlling load combination $1.2D + 1.6L$.
- ⁵ Calculation of weighted average: $1.2D + 1.6L = 1.2(0.3) + 1.6(0.7) = 1.48$
- ⁵ Values do not include edge distance or spacing reductions.

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PERFORMANCE TABLE

Trubolt Wedge Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Concrete*

ANCHOR DIA. In. (mm)	INSTALLATION TORQUE Ft. Lbs. (Nm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	f'c = 2000 PSI (13.8 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 6000 PSI (41.4 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
1/4 (6.4)	4 (5.4)	1-1/8 (28.6) 1-15/16 (49.2) 2-1/8 (54.0)		1,180 (5.2) 2,100 (9.3) 2,260 (10.1)	1,400 (6.2) 1,680 (7.5) 1,680 (7.5)	1,780 (7.9) 3,300 (14.7) 3,300 (14.7)	1,400 (6.2) 1,680 (7.5) 1,680 (7.5)	1,900 (8.5) 3,300 (14.7) 3,300 (14.7)	1,400 (6.2) 1,680 (7.5) 1,680 (7.5)
3/8 (9.5)	25 (33.9)	1-1/2 (38.1) 3 (76.2) 4 (101.6)		1,680 (7.5) 3,480 (15.5) 4,800 (21.4)	2,320 (10.3) 4,000 (17.8) 4,000 (17.8)	2,240 (10.0) 5,940 (26.4) 5,940 (26.4)	2,620 (11.7) 4,140 (18.4) 4,140 (18.4)	2,840 (12.6) 6,120 (27.2) 6,120 (27.2)	3,160 (14.1) 4,500 (20.0) 4,500 (20.0)
1/2 (12.7)	55 (74.6)	2-1/4 (57.2) 4-1/8 (104.8) 6 (152.4)	WS-Carbon or WS-G	4,660 (20.7) 4,660 (20.7) 5,340 (23.8)	4,760 (21.2) 7,240 (32.2) 7,240 (32.2)	5,100 (22.7) 9,640 (42.9) 9,640 (42.9)	4,760 (21.2) 7,240 (32.2) 7,240 (32.2)	7,040 (31.3) 10,820 (48.1) 10,820 (48.1)	7,040 (31.3) 8,160 (36.3) 8,160 (36.3)
5/8 (15.9)	90 (122.0)	2-3/4 (69.9) 5-1/8 (130.2) 7-1/2 (190.5)	Hot-Dipped Galvanized or WW-304 S.S.	6,580 (29.3) 6,580 (29.3) 7,060 (31.4)	7,120 (31.7) 9,600 (42.7) 9,600 (42.7)	7,180 (31.9) 14,920 (66.4) 15,020 (66.8)	7,120 (31.7) 11,900 (52.9) 11,900 (52.9)	9,720 (43.2) 16,380 (72.9) 16,380 (72.9)	9,616 (42.8) 12,520 (55.7) 12,520 (55.7)
3/4 (19.1)	110 (149.2)	3-1/4 (82.6) 6-5/8 (168.3) 10 (254.0)	or SWW-316 S.S.	7,120 (31.7) 10,980 (48.8) 10,980 (48.8)	10,120 (45.0) 20,320 (90.4) 20,320 (90.4)	10,840 (48.2) 17,700 (78.7) 17,880 (79.5)	13,720 (61.0) 23,740 (105.6) 23,740 (105.6)	13,300 (59.2) 20,260 (90.1) 23,580 (104.9)	15,980 (71.1) 23,740 (105.6) 23,740 (105.6)
7/8 (22.2)	250 (339.0)	3-3/4 (95.3) 6-1/4 (158.8) 8 (203.2)		9,520 (42.3) 14,660 (65.2) 14,660 (65.2)	13,160 (58.5) 20,880 (92.9) 20,880 (92.9)	14,740 (65.6) 20,940 (93.1) 20,940 (93.1)	16,580 (73.8) 28,800 (128.1) 28,800 (128.1)	17,420 (77.5) 24,360 (108.4) 24,360 (108.4)	19,160 (85.2) 28,800 (128.1) 28,800 (128.1)
1 (25.4)	300 (406.7)	4-1/2 (114.3) 7-3/8 (187.3) 9-1/2 (241.3)		13,940 (62.0) 14,600 (64.9) 18,700 (83.2)	16,080 (71.5) 28,680 (127.6) 28,680 (127.6)	20,180 (89.8) 23,980 (106.7) 26,540 (118.1)	22,820 (101.5) 37,940 (168.8) 37,940 (168.8)	21,180 (94.2) 33,260 (148.0) 33,260 (148.0)	24,480 (108.9) 38,080 (169.4) 38,080 (169.4)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

* For Tie-Wire Wedge Anchor, TW-1400, use tension data from 1/4" diameter with 1-1/8" embedment.

* For continuous extreme low temperature applications, use stainless steel.

Trubolt Wedge Anchors

Ultimate Tension and Shear Values (Lbs/kN) in Lightweight Concrete*

ANCHOR DIA. In. (mm)	INSTALLATION TORQUE Ft. Lbs. (Nm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	LIGHTWEIGHT CONCRETE f'c = 3000 PSI (20.7 MPa)		LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL f'c = 3000 PSI (20.7 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	25 (33.9)	1-1/2 (38.1) 3 (76.2)	WS-Carbon or WS-G	1,175 (5.2) 2,825 (12.6)	1,480 (6.6) 2,440 (10.9)	1,900 (8.5) 2,840 (12.6)	3,160 (14.1) 4,000 (17.8)
1/2 (12.7)	55 (74.6)	2-1/4 (57.2) 3 (76.2) 4 (101.6)	Hot-Dipped Galvanized or WW-304 S.S.	2,925 (13.0) 3,470 (15.4) 4,290 (19.1)	2,855 (12.7) 3,450 (15.3) 3,450 (15.3)	3,400 (15.1) 4,480 (19.9) 4,800 (21.4)	5,380 (23.9) 6,620 (29.4) 6,440 (28.6)
5/8 (15.9)	90 (122.0)	3 (76.2) 5 (127.0)	or SWW-316 S.S.	4,375 (19.5) 6,350 (28.2)	4,360 (19.4) 6,335 (28.2)	4,720 (21.0) 6,580 (29.3)	5,500 (24.5) 9,140 (40.7)
3/4 (19.1)	110 (149.2)	3-1/4 (82.6) 5-1/4 (133.4)		5,390 (24.0) 7,295 (32.5)	7,150 (31.8) 10,750 (47.8)	5,840 (26.0) 7,040 (31.3)	8,880 (39.5) ---

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

PERFORMANCE TABLE

Trubolt Wedge Anchors Recommended Edge and Spacing Distance Requirements for Shear Loads*

ANCHOR DIA. In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .60 In. (mm)	MIN. EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .20 In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING BETWEEN ANCHORS In. (mm) LOAD FACTOR APPLIED = .40
1/4 (6.4)	1-1/8 (28.6) 1-15/16 (49.2)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	2 (50.8) 1-15/16 (49.2)	1-5/16 (33.3) 1 (25.4)	--- ---	3-15/16 (100.0) 3-7/8 (98.4)	2 (50.8) 1-15/16 (49.2)
3/8 (9.5)	1-1/2 (38.1) 3 (76.2)		2-5/8 (66.7) 3-3/4 (95.3)	1-3/4 (44.5) 3 (76.2)	--- 1-1/2 (38.1)	5-1/4 (133.4) 6 (152.4)	2-5/8 (66.7) 3 (76.2)
1/2 (12.7)	2-1/4 (57.2) 4-1/8 (104.8)		3-15/16 (100.0) 5-3/16 (131.8)	2-9/16 (65.1) 3-1/8 (79.4)	--- 1-9/16 (39.7)	7-7/8 (200.0) 6-3/16 (157.2)	3-15/16 (100.0) 3-1/8 (79.4)
5/8 (15.9)	2-3/4 (69.9) 5-1/8 (130.2)		4-13/16 (122.2) 6-7/16 (163.5)	3-1/8 (79.4) 3-7/8 (98.4)	--- 1-15/16 (49.2)	9-5/8 (244.5) 7-11/16 (195.3)	4-13/16 (122.2) 3-7/8 (98.4)
3/4 (19.1)	3-1/4 (82.6) 6-5/8 (168.3)		5-11/16 (144.5) 6-5/16 (160.3)	3-3/4 (95.3) 5 (127.0)	--- 2-1/2 (63.5)	11-3/8 (288.9) 9-15/16 (252.4)	5-11/16 (144.5) 5 (127.0)
7/8 (22.2)	3-3/4 (95.3) 6-1/4 (158.8)		6-9/16 (166.7) 8-1/2 (215.9)	4-5/16 (109.5) 6-1/4 (158.8)	--- 3-1/8 (79.4)	13-1/8 (333.4) 12-1/2 (317.5)	6-9/16 (166.7) 6-1/4 (158.8)
1 (25.4)	4-1/4 (108.0) 7-3/8 (187.3)		7-7/8 (200.0) 10-1/16 (255.6)	5-1/8 (130.2) 7-3/8 (187.3)	--- 3-11/16 (93.7)	15-3/4 (400.1) 14-3/4 (374.7)	7-7/8 (200.0) 7-3/8 (187.3)

* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Trubolt Wedge Anchors Recommended Edge and Spacing Distance Requirements for Tension Loads*

ANCHOR DIA. In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .65 In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING AT WHICH THE LOAD FACTOR APPLIED = .70 In. (mm)
1/4 (6.4)	1-1/8 (28.6) 1-15/16 (49.2) 2-1/8 (54.0)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	2 (50.8) 1-15/16 (49.2) 1-5/8 (41.3)	1 (25.4) 1 (25.4) 13/16 (20.6)	3-15/16 (100.0) 3-7/8 (98.4) 3-3/16 (81.0)	2 (50.8) 1-15/16 (49.2) 1-5/8 (41.3)
3/8 (9.5)	1-1/2 (38.1) 3 (76.2) 4 (101.6)		2-5/8 (66.7) 3 (76.2) 3 (76.2)	1-5/16 (33.3) 1-1/2 (38.1) 1-1/2 (38.1)	5-1/4 (133.4) 6 (152.4) 6 (152.4)	2-5/8 (66.7) 3 (76.2) 3 (76.2)
1/2 (12.7)	2-1/4 (57.2) 4-1/8 (104.8) 6 (152.4)		3-15/16 (100.0) 3-1/8 (79.4) 4-1/2 (114.3)	2 (50.8) 1-9/16 (39.7) 2-1/4 (57.2)	7-7/8 (200.0) 6-3/16 (157.2) 9 (228.6)	3-15/16 (100.0) 3-1/8 (79.4) 4-1/2 (114.3)
5/8 (15.9)	2-3/4 (69.9) 5-1/8 (130.2) 7-1/2 (190.5)		4-13/16 (122.2) 3-7/8 (98.4) 5-5/8 (142.9)	2-7/16 (61.9) 1-15/16 (49.2) 2-13/16 (71.4)	9-5/8 (244.5) 7-1/16 (195.3) 11-1/4 (285.8)	4-13/16 (122.2) 3-7/8 (98.4) 5-5/8 (142.9)
3/4 (19.1)	3-1/4 (82.6) 6-5/8 (168.3) 10 (254.0)		5-11/16 (144.5) 5 (127.0) 7-1/2 (190.5)	2-7/8 (73.0) 2-1/2 (63.5) 3-3/4 (95.3)	11-3/8 (288.9) 9-15/16 (252.4) 15 (381.0)	5-11/16 (144.5) 5 (127.0) 7-1/2 (190.5)
7/8 (22.2)	3-3/4 (95.3) 6-1/4 (158.8) 8 (203.2)		6-9/16 (166.7) 6-1/4 (158.8) 6 (152.4)	3-5/16 (84.1) 3-1/8 (79.4) 3 (76.2)	13-1/8 (333.4) 12-1/2 (317.5) 12 (304.8)	6-9/16 (166.7) 6-1/4 (158.8) 6 (152.4)
1 (25.4)	4-1/2 (114.3) 7-3/8 (187.3) 9-1/2 (241.3)		7-7/8 (200.0) 7-3/8 (187.3) 7-1/8 (181.0)	3-15/16 (100.0) 3-11/16 (93.7) 3-9/16 (90.5)	15-3/4 (400.1) 14-3/4 (374.7) 14-1/4 (362.0)	7-7/8 (200.0) 7-3/8 (187.3) 7-1/8 (181.0)

* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Combined Tension and Shear Loading—for Trubolt Anchors

Allowable loads for anchors subjected to combined shear and tension forces are determined by the following equation:

$$(P_s/P_t)^{5/3} + (V_s/V_t)^{5/3} \leq 1$$

P_s = Applied tension load V_s = Applied shear load P_t = Allowable tension load V_t = Allowable shear load

2.6 - B - STEAM GATE VALVE 1/2 TO 2" THREADED



Job Name:	
Job Location:	
Engineer:	
Contractor:	
Tag:	
PO#:	
Rep:	
Wholesale Dist.:	

DESCRIPTION

The **Apollo® Model 111T Bronze Gate Valve** provides a cost effective "made in the USA" alternative to globally sourced multi-turn valves. These valves are cast, machined, assembled, and tested in South Carolina. The Apollo® gate valve is ideal for steam and liquid service and can reliably be installed in most plumbing and heating systems including building service piping and OEM applications.

FEATURES

- Guided Solid Bronze Disc Wedge
- Adjustable Graphite Stem Packing
- NPT Connection
- Rising Stem
- Union Bonnet
- Dezincification Resistant Bronze Construction
- Rugged Malleable Iron Hand Wheel
- Factory tested to MSS SP-80
- **100% Cast, Machined and Assembled in the USA**
- **ARRA Compliant**

PERFORMANCE RATING

- Saturated Steam: 300 psi (20.7 Bar)
 - Cold Working Pressure: 1000 psi @100°F (68.9 Bar @ 38°C)
 - Temperature Range*: -20°F to 422°F (-29°C to 216°C)
- * Valves should be in open position to allow complete drainage during freezing conditions.*

APPROVALS

- MSS SP-80 - Bronze Gate, Globe, Angle & Check Valves - Type 2
- ASME B1.20.1 - Pipe Threads, General Purpose (Inch)
- CRN OC14667.5

STANDARD MATERIALS LIST

BODY	Bronze, ASTM B61
BONNET	Bronze, ASTM B61
STEM	ASTM B21 UNS C46400
UNION NUT	Bronze, ASTM B61
DISC WEDGE	Bronze, ASTM B62
PACKING	Grafoil® (Asbestos Free)
PACKING NUT	Brass, ASTM B16
HAND WHEEL	Malleable Iron
NAMEPLATE	Aluminum

DIMENSIONS

MODEL NO.	PART NO.	SIZE (IN.)	HEIGHT OPEN (IN.)	LENGTH (IN.)	WEIGHT (LB.)	CV (GPM)
111T12	30-443-01	1/2"	4.97	2.31	1.4	12.5
111T34	30-444-01	3/4"	6.22	2.56	2.3	24.0
111T1	30-445-01	1"	6.94	2.89	3.5	72.3
111T114	30-446-01	1-1/4"	8.29	3.01	5.1	80
111T112	30-447-01	1-1/2"	9.28	3.05	6.8	119
111T2	30-448-01	2"	11.37	3.08	9.6	338

621F-LFA

Class 250, Outside Screw & Yoke, Gate Valve

LEAD FREE

2.6 - A- STEAM GATE VALVE 21/2 TO 12" DID NOT HAVE CLASS 300 ONLY CLASS 250



Job Name:	
Job Location:	
Engineer:	
Contractor:	
Tag:	
PO#:	
Rep:	
Wholesale Dist:	

DESCRIPTION

The Apollo International™ Model 621F-LFA Flanged Cast Iron Gate Valve provides full flow capabilities. The Model 621F-LFA Gate Valve can be reliably installed in plumbing and heating systems (or building service piping). Valves are MSS SP-70 compliant and include NSF lead free certifications.

FEATURES

- Compatible with ANSI 250# & 300# Flanges
- Full Port
- Bronze Mounted Seat Rings/Trim
- Solid Wedge
- Adjustable Graphite Stem Packing
- Outside Screw & Yoke
- Flanged Connection
- Bolted Bonnet
- Rugged Iron Hand Wheel
- Back Seat Protection
- FDA Food Grade Epoxy Powder Coat Finish

STANDARDS

- MSS SP-70 - Gray Iron Gate Valves Flanged and Threaded - Type 1
- ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves

APPROVALS

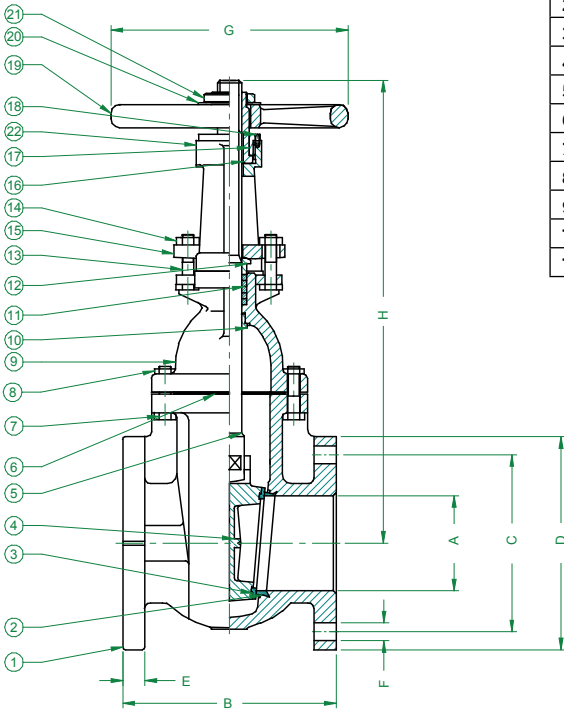
- NSF/ANSI 372 Lead Free
- NSF/AND 61 Water Quality

PERFORMANCE RATING

- Cold Working Pressure:
500 psi (34.5 bar) at 100°F (37.78°C)
- Saturated Steam:
250 psi (17.2 bar) at 406°F (207°C)
- Temperature Range: -20°F to 406°F Max

STANDARD MATERIALS LIST

1	Body	Cast Iron (ASTM A126 CL B)	12	Packing Gland	Cast Lead Free Bronze
2	Seat Rings	Cast Lead Free Bronze	13	Gland Follower Bolts	Carbon Steel (ASTM A307 B)
3	Wedge Face Rings	Cast Lead Free Bronze	14	Gland Follower Nuts	Carbon Steel (ASTM A307 B)
4	Wedge	Cast Iron (ASTM A126 CL B)	15	Gland Follower	Ductile Iron (ASTM A536 65-45-12)
5	Stem	Cast Lead Free Bronze	16	Yoke Bushing	Cast Lead Free Bronze
6	Body Gasket	Graphite	17	Yoke Bushing Nut	Cast Iron (ASTM A126 CL B)
7	Bolts	Carbon Steel (ASTM A307 B)	18	Screw	Carbon Steel (ASTM A307 B)
8	Nuts	Carbon Steel (ASTM A307 B)	19	Handwheel	Cast Iron (ASTM A126 CL B)
9	Bonnet	Cast Iron (ASTM A126 CL B)	20	Nameplate	Aluminum
10	Back Seat Bushing	Cast Lead Free Bronze	21	Handwheel Nut	Ductile Iron (ASTM A536 65-45-12)
11	Packing	PTFE	22	Yoke	Cast Iron (ASTM A126 CL B)



DIMENSIONS

PART NUMBER	SIZE (IN.)	DIMENSIONS (IN.)								WT. (LB.)	CV (TYP)
		A	B	C	D	E	F	G	H (OPEN)		
6GA218B1LFA	2"	2.00	8.50	5.00	6.50	0.88	0.75	7	14.96	44	328
6GA219B1LFA	2.5"	2.50	9.50	5.88	7.50	1.00	0.88	7	16.93	57	482
6GA210B1LFA	3"	3.00	11.12	6.62	8.25	1.12	0.88	8	19.09	71	744
6GA21AB1LFA	4"	4.00	12.00	7.88	10.00	1.25	0.88	10	24.21	121	1316
6GA21BB1LFA	5"	5.00	15.00	9.25	11.00	1.38	0.88	12	27.56	165	2130
6GA21CB1LFA	6"	6.00	15.88	10.62	12.50	1.44	0.88	12	32.87	216	3176
6GA21EB1LFA	8"	8.00	16.50	13.00	15.00	1.62	1.00	14	39.76	302	5692
6GA21GB1LFA	10"	10.00	18.00	15.25	17.50	1.88	1.12	16	48.03	481	8972
6GA21HB1LFA	12"	12.00	19.75	17.75	20.50	2.00	1.25	18	56.50	642	13352

Cv = GPM @1 psi pressure drop, 60°F water

*Cv values are estimates only

**LFA models replace LF models

*LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.

161T-LF Series

Class 125, Bronze Disc, NPT Swing Check

LEAD FREE

2.8 CHECK VALVES 1/2 TO 2"



Job Name:	
Job Location:	
Engineer:	
Contractor:	
Tag:	
PO#:	
Rep:	
Wholesale Dist.:	

DESCRIPTION

The **lead free* Apollo® Model 161T-LF (61YLF Series) Swing Check** provides a reliable, long lasting, "Made in the USA" alternative to globally sourced check valves for potable water service. These valves are cast, machined, assembled, and tested in South Carolina using proven ASTM quality materials. The Apollo® swing check may be installed in either horizontal or vertical orientation with upward flow.

FEATURES

- Dezincification Resistant Bronze Construction
- Renewable Bronze Seat Disc
- 100% Factory Tested per MSS SP-139
- NPT Connection
- **Cast, Machined and Assembled in the USA**
- ARRA Compliant

APPROVALS

- MSS SP-80 Design & Tested
- MSS SP-139, "Copper Alloy Gate, Globe, & Check Valves"
- NSF/ANSI 372 Lead Free, 3rd Party Certified
- ASME B1.20.1, "Pipe Threads, General Purpose (Inch)"
- CSA B51 CRN OC14667.

STANDARD MATERIALS LIST

BODY	ASTM B584-C89836 Bronze
CAP	ASTM B584-C89836 Bronze
HANGER	304 Stainless Steel or ASTM B584 C89836 Bronze
PIN	304 Stainless Steel
SEAT	C27451 Lead Free* Brass
PLUG	ASTM B16 Brass

PERFORMANCE RATING

- Cold Working Pressure:
200 psi (13.8 Bar) at 100°F
- Saturated Steam: 125 psi (8.6 Bar) at 353°F
- Temperature Range: -20°F to 406°F

PRECAUTIONARY NOTE:

Not recommended for applications which may induce pulsation or repetitive vibration. See Installation Manual for details.

DIMENSIONS

MODEL NUMBER	PART NUMBER	SIZE (IN.)	HEIGHT (IN.)	LENGTH (IN.)	WEIGHT (LB.)	CV (GPM)
161T14LF	61YLF-191-01	1/4"	1.51	2.14	.64	2.6
161T38LF	61YLF-192-01	3/8"	1.51	2.14	.62	4.5
161T12LF	61YLF-193-01	1/2"	1.65	2.48	.73	7.0
161T34LF	61YLF-194-01	3/4"	1.9	2.94	1.1	12.0
161T1LF	61YLF-195-01	1"	2.26	3.57	1.7	28.6
161T14LF	61YLF-196-01	1-1/4"	2.99	4.50	3.4	39.0
161T12LF	61YLF-197-01	1-1/2"	2.99	4.50	3.1	56.0
161T2LF	61YLF-198-01	2"	3.74	5.25	5.5	152.0

Warning: Do not use in reciprocating compressor service.

**LEAD FREE: The wetted surfaces of this product shall contain no more than 0.25% lead by weighted average. Complies with Federal Public Law 111-380. ANSI 3rd party approved and listed.*

"Apollo" INTERNATIONAL

SUBMITTAL SHEET

910F Series

Class 125 Swing Check Valve

2.8 CHECK VALVES 21/2" TO 20"



DESCRIPTION

The **Apollo International™** Model 910F Flanged Cast Iron Swing Check valve provides full flow capabilities. It provides reliable and economical protection against reverse flow. The Model 910F Swing Check valve can reliably be installed in most plumbing and heating systems (or building service piping).

FEATURES

- Compatible with ANSI 125# & 150# Flanges
- Full Port
- Minimal Pressure Drop
- Flanged Connection
- Bolted Bonnet
- Integral Bronze Seat

STANDARDS

- MSS SP-71, "Gray Iron Swing Check Valves Flanged and Threaded"
- ASME B16.10, "Face-to-Face and End-to-End Dimensions of Valves"

PERFORMANCE RATING

- Saturated Steam:
125 psi (8.6 Bar) to 353°F (178°C) (2"-12")
100 psi (6.9 Bar) to 338°F (170°C) (14"-20")
- Cold Working Pressure:
200 psi (13.8 Bar) at 100°F (2"-12")
150 psi (10.3 Bar) at 100°F (14"-20")
- Temperature Range*:
-20°F to 406°F

* Valves should be in open position to allow complete drainage during freezing conditions.

STANDARD MATERIALS LIST

Part Name	Material
Bolts	Steel (ASTM A307 B)
Nameplate	Aluminum
Bonnet	Cast Iron (ASTM A126 CL B)
Body Gasket	Graphite
Nuts	Steel (ASTM A307 B)
Side Plug	Brass (ASTM B16)
Gasket	Graphite
Hanger Pin	Brass (ASTM B16)
Hanger	Ductile Iron (ASTM A536 65-45-12)
Disc Ring	Cast Bronze (2"-6") Cast Iron (8"-20")
Disc	Cast Iron (ASTM A126 CL B)
Washer	Steel (ASTM A307 B)
Split Pin	Stainless Steel (ASTM 420 S42000)
Seat Ring	Cast Bronze (2"-6") Cast Iron (8"-20")
Body	Cast Iron (ASTM A126 CL B)
Disc Nut	Steel (ASTM A307 B)
Stud Bolt	Steel (ASTM A307 B)

ORDER INFORMATION

Size (in.)	Part Number
2"	6SC108B1
2-1/2"	6SC109B1
3"	6SC100B1
4"	6SC10AB1
5"	6SC10BB1
6"	6SC10CB1
8"	6SC10E01
10"	6SC10G01
12"	6SC10H01
14"	6SC10J01
16"	6SC10K01
18"	6SC10M01
20"	6SC10N01

Apollo Valves / **Conbraco Industries, Inc.**
701 Matthews Mint-Hill Road, Matthews, NC 28105 USA
www.apollovalves.com | (704) 841-6000

This specification is provided for reference only. Conbraco Industries Inc. reserves the right to change any portion of this specification without notice and without incurring obligation to make such changes to Conbraco products previously or subsequently sold. Please visit our website @ www.apollovalves.com for the most current information.

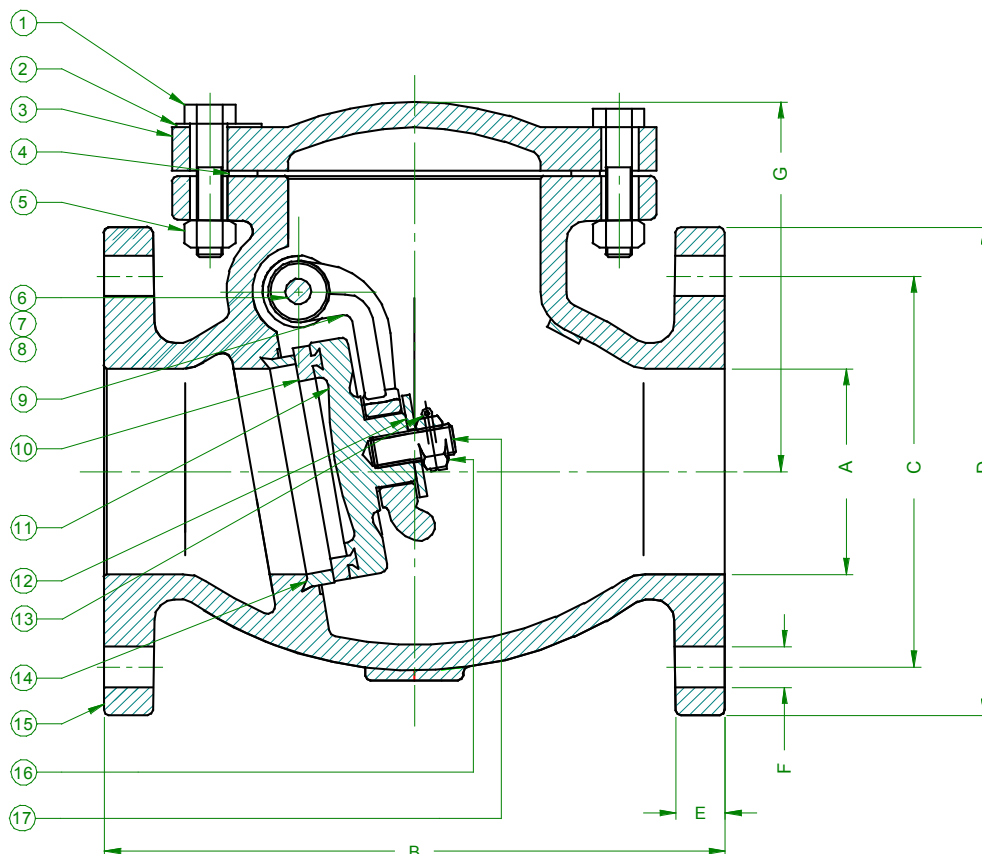


"Apollo" INTERNATIONAL

SUBMITTAL SHEET

910F Series

Class 125 Swing Check Valve



Size (in.)	Dimensions (in.)							Wt. (lbs.)	Cv (Typ)
	A	B	C	D	E	F	G		
2"	2.00	8.00	4.75	6.00	0.62	0.75	4.41	26	132
2.5"	2.50	8.50	5.50	7.00	0.69	0.75	5.24	39	192
3"	3.00	9.50	6.00	7.50	0.75	0.75	5.67	47	298
4"	4.00	11.50	7.50	9.00	0.94	0.75	6.61	82	526
5"	5.00	13.00	8.50	10.00	0.94	0.88	7.80	124	852
6"	6.00	14.00	9.50	11.00	1.00	0.88	8.54	160	1272
8"	8.00	19.50	11.75	13.50	1.12	0.88	10.28	271	2278
10"	10.00	24.50	14.25	16.00	1.19	1.00	11.30	437	3588
12"	12.00	27.50	17.00	19.00	1.25	1.00	12.56	644	5342
14"	14.00	31.00	18.75	21.00	1.38	1.14	17.50	950	6512
16"	16.00	36.00	21.25	23.50	1.44	1.14	23.45	1160	8626
18"	18.00	36.00	22.75	25.00	1.56	1.25	27.50	1720	11488
20"	20.00	40.00	25.00	27.50	1.69	1.25	29.25	2094	14304

$C_v = \text{GPM} @ 1 \text{ psi pressure drop, } 60^\circ\text{F water}$

* C_v values are estimates only

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Proven Every Day // Proven Everywhere®



USDA approved for use in federally inspected meat and poultry plants.

Slic-tite® Paste with PTFE

Premium Thread Sealant

FEATURES:

- Slic-tite® contains more PTFE than other national brands. The higher concentration of PTFE particles provides greater sealing power on all tapered pipe threads including those that are damaged.
- Brushes easily on wet or oily threads.
- Sticks to hot, oily threads, will not run off. Ideal for use on production lines using high speed pipe threading machines.
- The non-toxic, non-drying formula will not harden or crack in the pipe joint. Provides easy disassembly and break out.
- Seals to high pressures: 10,000 PSI for Liquids, 3,000 PSI for Gases.
- Sealing temperature range: -50° to 500°F (-46°C to 260°C).
- Meets Fed. Spec. TT-S-1732
- Slic-tite contains a product made from PTFE and other PTFE resins to assure high performance.

TYPICAL APPLICATIONS:

- Slic-tite seals all types of pipe threads: steel, stainless steel, brass, aluminum, iron, and PVC, CPVC and ABS plastic.
- Recommended Services: water, natural gas, LP gases, steam, air, gasoline, kerosene, Refrigerants, ammonia, caustics, and acids. Contact factory for specific use recommendations. NOT RECOMMENDED FOR USE WITH OXYGEN SERVICE. Use OXY-TITE®.



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RECOMMENDED INDUSTRIES:

- Plumbing
- AC/R
- Industrial Piping
- Chemical Processing Plants
- Manufacturing Plants
- Gas Utilities
- Fire Sprinkler Piping
- Irrigation Systems

ORDERING INFORMATION

Part No.	Size	QTY/Case	Part No.	Size	QTY/Case
41209	1/4 pt. BIC	12	42013	1 qt. Flat Top	12
42009	1/4 pt. BIC	24	42049	1 qt. BIC	12
41219	1/2 pt. BIC	12	42014	1 gal.	4
42019	1/2 pt. BIC	24	42015	5 gal.	1
42012	1 pt. Flat Top	24	42069	55 gal.	1
42029	1 pt. BIC	24			

BIC = Brush in Cap

LP97R00010



Call, write or email for additional information

LA-CO Industries Inc.
1201 Pratt Boulevard
Elk Grove Village, Illinois 60007-5746
1-800-621-4025 • 1-847-956-7600 • Fax: 1-800-448-5436
www.laco.com
Email: customer_service@laco.com
Family owned and operated since 1934

Fleetweld® 5P

Mild Steel, Cellulosic • AWS E6010

Key Features

- ▶ Deep arc penetration
- ▶ Light slag with minimal arc interference
- ▶ Excellent vertical and overhead capability

Typical Applications

- ▶ Steel with moderate surface contaminants
- ▶ Cross country and in-plant pipe welding
- ▶ Square edge butt welds
- ▶ Welding on galvanized and specially coated steels

Conformances

AWS A5.1/A5.1M: 2004	E6010
ASME SFA-A5.1:	E6010
ABS:	E6010
Lloyd's Register:	3M
CWB/CSA W48-06:	E4310
TUV:	EN ISO 2560-A: E 42 3 C25

Welding Positions

All

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	5 lb (2.3 kg) Plastic Tube 20 lb (9.1 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032402	ED032561	ED010211
1/8 (3.2)	14 (350)	ED032403	ED032562	ED010203
5/32 (4.0)	14 (350)		ED032563	ED010216
3/16 (4.8)	14 (350)			ED010207
7/32 (5.6)	14 (350)			ED010219
1/4 (6.4)	14 (350)			ED010200

MECHANICAL PROPERTIES⁽¹⁾ – As Required per AWS A5.1/A5.1M: 2004

	Yield Strength ⁽²⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @-29°C (-20°F)
Requirements - AWS E6010	330 (48) min.	430 (60) min.	22 min.	27 (20) min.
Typical Results ⁽³⁾ - As-Welded	420-475 (61-69)	515-570 (75-83)	25-31	41-68 (30-50)

DEPOSIT COMPOSITION⁽¹⁾ – As Required per AWS A5.1/A5.1M: 2004

	%C	%Mn	%Si	%P	%S
Requirements - AWS E6010	0.20 max.	1.20 max.	1.00 max.	Not Specified	Not Specified
Typical Results ⁽³⁾ - As-Welded	0.09-0.17	0.40-0.63	0.09-0.43	0.005-0.017	0.005-0.014
	%Ni	%Cr	%Mo	%V	
Requirements - AWS E6010	0.30 max.	0.20 max.	0.30 max.	0.08 max.	
Typical Results ⁽³⁾ - As-Welded	0.01-0.05	0.01-0.05	≤ 0.03	≤ 0.01	

TYPICAL OPERATING PROCEDURES

Polarity ⁽⁴⁾	Current (Amps)					
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)	7/32 in (5.6 mm)	1/4 in (6.4 mm)
DC+	40-80	70-130	90-165	140-225	200-275	220-325
DC-	50-85	75-135	100-175	–	–	–

⁽¹⁾Typical all weld metal. ⁽²⁾Measured with 0.2% offset. ⁽³⁾See test results disclaimer below. ⁽⁴⁾Preferred polarity is listed first.

Material Safety Data Sheets (MSDS) and Certificates of Conformance are available on our website at www.lincolnelectric.com

TEST RESULTS

Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

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The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

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Excalibur® 7018 MR®

Mild Steel, Low Hydrogen • AWS E7018 H4R

Key Features

- ▶ Improved coating integrity
- ▶ Extreme bendability
- ▶ 60% less moisture pickup vs. competition
- ▶ Reduction of arc starting porosity
- ▶ Clear puddle and a smooth arc

Typical Applications

- ▶ Power generation
- ▶ Pressure piping
- ▶ Petrochemical
- ▶ Mild steel
- ▶ Pressure vessels

Conformances

AWS A5.1/A5.1M: 2004	E7018 H4R
ASME SFA-A5.1:	E7018 H4R
ABS:	3Y H5
Lloyd's Register:	3YM H5
DNV Grade:	3 YH5
GL:	3YH5
BV Grade:	3YHHH
CWB/CSA W48-06:	E4918

Welding Positions

All, except vertical down

DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	1 lb (0.5 kg) Plastic Tube 6 lb (2.7 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032086	ED032588	ED028280
1/8 (3.2)	14 (350)	ED031468	ED032589	ED028281
5/32 (4.0)	14 (350)		ED032590	ED028282
3/16 (4.8)	14 (350)			ED028283
7/32 (5.6)	18 (450)			ED028917
1/4 (6.4)	18 (450)			ED028918

MECHANICAL PROPERTIES⁽¹⁾

	Yield Strength ⁽²⁾ MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
Requirements - AWS E7018 H4R	400 (58) min.	490 (70) min.	22 min.	27 (20) min.
Typical Results ⁽³⁾ - As-Welded	430-510 (62-74)	510-605 (74-88)	25-37	121-332 (89-246)

DEPOSIT COMPOSITION⁽¹⁾

	%C	%Mn	%Si	%P	%S	%Ni
Requirements - AWS E7018 H4R	0.15 max.	1.60 max.	0.75 max.	0.035 max.	0.035 max.	0.30 max.
Typical Results ⁽³⁾	0.03-0.08	1.01-1.55	0.34-0.68	0.01-0.02	≤ 0.01	0.01-0.06
	%Cr	%Mo	%V	%Mn + Ni + Cr + Mo + V	Diffusible Hydrogen (mL/100g weld metal)	
Requirements - AWS E7018 H4R	0.20 max.	0.30 max.	0.08 max.	1.75 max.	4.0 max.	
Typical Results ⁽³⁾	0.02-0.07	≤ 0.05	≤ 0.02	1.04-1.75	2-3	

TYPICAL OPERATING PROCEDURES

	Current (Amps)					
Polarity ⁽⁴⁾	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)	7/32 in (5.6 mm)	1/4 in (6.4 mm)
DC+	70-110	90-160	130-210	180-300	250-330	300-400
AC	80-120	100-160	140-210	200-300	270-370	325-420

⁽¹⁾Typical all weld metal. ⁽²⁾Measured with 0.2% offset. ⁽³⁾See test results disclaimer on pg. 18. ⁽⁴⁾Preferred polarity is listed first.

* Extreme bendability apply to 3/32, 1/8 and 5/32 in. diameters.

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Mild Steel, Low Hydrogen • AWS E7018 H4R

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22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.

Phone: +1.216.481.8100 • www.lincolnelectric.com